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11. SUPPLEMENTARY NOTES

The CEFA study (Volumes I & II) is an integral effort of TRAC-LEE's Joint Venture Capstone CSS Analysis. This study assesses the risks associated with the set of candidate Force XXI (FXXI) CSS Enablers/Initiatives (E/I).

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13. ABSTRACT (Maximum 200 words)

This study was performed at the direction of the Deputy CG, US Army Training and Doctrine Command (TRADOC).

The study purpose was: to assess the new FXXI CSS E/I, thereby providing the Commander (CDR), Combined Arms Support Command (CASCOM) with a tool to aid decision making related to mitigating E/I peacetime (programmatic) and wartime risks.

The study objective was: to answer the question "What are the risks associated with the FXXI CSS E/I?" The following four study issues were relevant to answering this major study objective. (1) What are the FXXI CSS E/I as approved by the CASCOM CDR? (2) What are the associated peacetime (programmatic) risks for each CSS E/I? (3) What are the wartime employment risks for each CSS E/I? and (4) What is the basis for assessing peacetime and wartime risk considerations?

The principal study conclusion was: the CSS Subject Matter Experts (SME) estimated that most of the 65 FXXI CSS E/I will not be fielded by Fiscal Year (FY) 10. Based on their estimates, any decisions, especially reductions in manpower, which rely on the existence of the E/I during FXXI are at risk.

The principal study recommendation was: that HQ TRADOC and the CSS community reassess any ongoing FXXI cuts in CSS spaces attributed to planned reductions in manpower requirements due specifically to fielding the FXXI CSS E/I. For the most part, these reductions are asserted to accrue from hypothesized increases in efficiencies/effectiveness attributable to fielding the new FXXI CSS E/I.

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30 Jun 98

Dear Sir,

Inclosed find my Combat Service Support (CSS) Enabler Functional Assessment (CEFA) study. It is in 2 Volumes - Unclassified.

Also find a SF 298 and a return Post Card.

If I've failed to provide anything, please contact me at DSN 539-1838 / com (804)-765-1838. I have a phone message recorder if I am not at my desk.

2 Incl
as stated

Sincerely

Jim Behne
TRAC-LEE
FT LEE, VA.

TRAC-TR-1597
December 1997

TRADOC Analysis Center
Fort Lee, Virginia 23801-1511

COMBAT SERVICE SUPPORT ENABLER FUNCTIONAL ASSESSMENT
(CEFA)

MAIN REPORT
(Technical Notes)



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FOREWORD

The Combat Service Support (CSS) Enabler Functional Assessment (CEFA) was conducted at the direction of the Deputy Commanding General of the United States Army (USA) Training and Doctrine Command (TRADOC). It was performed during the period Jan-Dec 97, and was a collaborative effort between the TRADOC Analysis Center element at Fort Lee (TRAC-LEE), the USA Combined Arms Support Command (CASCOM), CASCOM associated Schools and Centers, and the USA Medical Department Center and School. The CEFA purpose was to investigate the risks associated with fielding each of the then identified FORCE XXI (FXXI) CSS Enablers and Initiatives (E/I). This effort was intended to be a "snapshot-in-time," with information collected primarily during the period Feb-Jun 97. At that time CASCOM was assessing the relationship of timely fielding of the FXXI CSS E/I to that of developing the FXXI Heavy Division Support Command (DISCOM). Report information gathered during the interview portions of this study was based primarily on military judgement from CSS subject matter experts (SME). Analyses, conclusions and recommendations resulting from this CEFA investigative research provide the reader with valuable insights as to the (1) perception of FXXI CSS E/I risk at that time, and (2) dependency of the FXXI DISCOM on the fielding of new CSS E/I.

Some of the data and SME opinions analyzed to develop selected CEFA risk profiles may have been time sensitive. Thus, some of the information discussed herein may have changed in the recent past given the volatility of both funding profiles and other programmatic actions for selected E/I. Nevertheless, this CEFA serves as an exceptional compendium of investigative research performed during a period when no similar risk assessments were being performed. Given the availability of future resources to update this effort, TRAC-LEE's CEFA represents a benchmark against which similar FXXI CSS E/I risk assessments should be measured.



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STUDY GIST

Reference: This study was performed at the direction of the Deputy Commanding General, Headquarters (HQ), US Army Training and Doctrine Command (TRADOC), Ft Monroe, VA.

Purpose: To assess the new FORCE XXI (FXXI) Combat Service Support (CSS) enablers/initiatives (E/I), thereby providing the Commander (CDR), Combined Arms Support Command (CASCOM) with a tool to aid decision making related to mitigating E/I peacetime (programmatic) and wartime risks.

The principal Conclusion was: The CSS Subject Matter Experts (SME) estimated that most of the 65 Force XXI (FXXI) CSS E/I will not be fielded by Fiscal Year (FY) 10. Based on their estimates, any decisions, especially reductions in manpower, which rely on the existence of the E/I during FXXI are at risk.

The principal Recommendation was: That HQ TRADOC and the CSS community reassess any ongoing FXXI cuts in CSS spaces attributed to planned reductions in manpower requirements due specifically to fielding the FXXI CSS E/I. For the most part, these reductions are asserted to accrue from hypothesized increases in efficiencies/effectiveness attributable to fielding the new FXXI CSS E/I.

The main Assumptions were:

(1) **Individual SME Risk Aversion.** The insights derived from this analysis were based on each responding SME's own personal risk aversion (and in some small part on that of the study team). It is conceivable that for a different set of respondents a different assessment of risks could have been obtained. However, it was assumed that the SME represented a reasonable cross section of current military risk takers/risk avoiders, and their responses represented the official position of their respective Directors of Combat Developments (DCD).

(2) **FXXI CSS E/I.** As discussed in detail in Volume I, each FXXI CSS E/I approved by its proponent CSS DCD was assumed to have functionally unique "inherent worth for indirectly contributing to battlefield effectiveness." Consequently, each E/I represents a reasonably independent method for CSS proponents to obtain their requisite Functional Operational Capabilities.

The major Constraints and Limitations were:

(1) **CSS Enabler Functional Assessment (CEFA) is a "SNAPSHOT" in Time.** This CEFA and its findings are limited to the information obtained from CSS SME during Apr-Jun 97. Information provided the study team often was time sensitive and in a few cases required clarification among responding SME. Funding information and data to be gained from upcoming tests were often not available. Due to resource constraints, updating of data once collected was not possible.

(2) **Absence of Any Written CEFA Study Tasker.** This analysis was constrained by the lack of command emphasis. No HQ TRADOC written tasker was ever issued for conducting this CEFA. Consequently, it was *immensely difficult* for the study team to negotiate a priority for obtaining required support within the TRADOC CSS community at large.

(3) Quantitative Estimates of Increases in E/I Efficiency and Effectiveness and Decreases in Manpower Requirements. It was the original intent of this CEFA to acquire as much quantitative information as possible to support SME individual risk assessments. Of specific interest was the acquisition of quantified estimates (ranges) of (a) increases in efficiencies/effectiveness, and (b) decreases in manpower requirements attributable to fielding a given CSS FXXI E/I. However, many of those items designated by the CSS community to be FXXI CSS E/I, and therefore candidates for this CEFA, are in their early stages of development. Consequently, many of the SME simply could not provide quantitative answers. Most SME were also reluctant to even provide "subjective ranges of estimates" for increases in efficiencies and effectiveness and decreases in manpower requirements. In many cases, SME provided answers concerning increases in efficiency/effectiveness based solely on their military judgment (MJ) and personal experiences, with the study team accepting such responses in the absence of any quantitative data.

The Scope of the study: Focused on examining only those CSS E/I planned for the Joint Venture axis of FXXI, primarily at the Division, Corps and Theater levels.

The study Objective was to: Answer the question "What are the risks associated with the FXXI CSS E/I?" The following four study issues were relevant to answering this major study objective. (1) What are the FXXI CSS E/I as approved by the CASCOM CDR? (2) What are the associated peacetime (programmatic) risks for each CSS E/I? (3) What are the wartime employment risks for each CSS E/I? and (4) What is the basis for assessing peacetime and wartime risk considerations?

The Basic Approach was to: First focus on obtaining from recent Army publications as many identified FXXI CSS E/I as possible. This then served as the first set of "candidate" FXXI CSS E/I for review and approval by CSS proponent DCD. Using a questionnaire which addressed both peacetime (programmatic) and wartime risk factors, the study team interviewed DCD-appointed SME concerning their proponent FXXI CSS E/I. As a part of the questionnaire process, SME identified which of their E/I were at risk and the contributing factors. Where appropriate, their reviews even included information about the risk of other systems deemed essential for the proper functioning of their given E/I.

The study Sponsor was: HQ TRADOC.

The study Proponent was: CASCOM.

The study Agency was: United States Army Training and Doctrine Command Analysis Center (TRAC-LEE), ATTN: ATRC-L, 401 1st Street, Ft Lee, VA 23801-1511.

ACKNOWLEDGMENTS

This effort was possible only with the enthusiastic participation of many CSS SME who answered the CEFA questionnaires and participated in subsequent interviews with the CEFA study team.

Special thanks are due to CASCOM (Mr. Richard Dodson), the Advanced Engineering and Planning Corp., Inc. (AEPCO), and TRAC-LEE personnel (Dr. Jerry Klopp, Dr. Gordon Goodwin, Mr. John Noble, Mr. Erik Tollefson and Mr. Drew Cherry) for their valuable insights, patience and overall assistance.

Last but certainly not least, special thanks are due to Ms. Kathy Speitel, TRAC-LEE, for her editorial reviews of this report.

EXECUTIVE SUMMARY

ES-1. Purpose. This Executive Summary reports the most significant insights derived from the CSS Enabler Functional Assessment (CEFA) conducted by TRAC-LEE. The purpose of this analysis was to provide insights into the risks associated with developing and fielding new Force XXI (FXXI) CSS Enablers/Initiatives (E/I), thereby providing the CDR, Combined Arms Support Command (CASCOM) with analysis to aid decision making related to mitigating E/I risks. Further, this CEFA serves as a reference document and baseline for future E/I reviews.

ES-2. Introduction.

a. Background. Over about the last 20 years the US Army has gone through several force redesigns to enhance its effectiveness in the face of an ever-changing threat. In the 1970s the Army redesigned into the Division 86 structure, and then in the mid 1980s into the Army of Excellence (AOE). Now and in support of a new military strategy severely impacted by declining budgets, the Army again is undergoing another transformation (Force XXI [FXXI]) as it prepares to move into the 21st Century. CASCOM is heavily committed to this transformation as it redesigns Division, Corps and Theater CSS units and capabilities to best support the FXXI maneuver commander.

(1) Right-size FXXI Interim Division Design (IDD) Division Support Command (DISCOM). As part of the ongoing FXXI redesign efforts, in late 1996 the CASCOM staff initiated a redesign of the IDD heavy division DISCOM. Their effort was based on the Mar 96 Training and Doctrine Command (TRADOC) Pamphlet (Pam) 525-71, "FXXI Division Operations Concept" which served as the foundation for developing the organizational designs of FXXI divisions. The FXXI CSS concept, as outlined in a then Sep 96 CASCOM draft concept paper, proposed a redesigned divisional CSS structure. CASCOM's Internet Home Page¹ contains an in-depth discussion of the most current FXXI Right-size DISCOM designs.

(a) **The AOE heavy division has an approximate total of 5169 CSS manpower requirements**, divided between the DISCOM at 3219 spaces and the rest of the division at 1950 spaces. Due to proposed changes in FXXI CSS organizational structures and changes to the ways of performing CSS afforded by such business practices as Battlefield Distribution (BD) and Velocity Management (VM), in late 1996 TRADOC reassessed Division-level AOE CSS manpower spaces. This resulted in a proposed FXXI IDD DISCOM of 4209 spaces, with the rest of the IDD having only 272 CSS spaces, for a FXXI heavy division total of 4481. The historical basis supporting the development of these numbers resides with the CASCOM. It is not within the scope of this study to determine the efficacy of CASCOM's development of the IDD Right-size DISCOM. However, CASCOM recognized in designing the FXXI IDD DISCOM that it relied heavily on future FXXI CSS E/I and their assumed potential for reducing

¹ CASCOM's Internet home page (<http://www.cascom.army.mil>).

manpower requirements. This historical development is important to understanding the genesis of this CEFA.

(b) FXXI IDD contained a proposed decrease of about 688 division-level CSS spaces when compared to the AOE heavy division. The reduction of about 300 of these spaces was directly attributed to new maintenance and quartermaster organizational concepts and structures inherent in the new CSS designs for the FXXI IDD DISCOM. However, the other reduction in about 388 division-level CSS spaces was generally attributed to the assumed manpower reductions resulting from synergistic gains in efficiencies and effectiveness attributed to fielding the planned FXXI CSS E/I.

(c) In late 1996 CASCOM relooked initial reductions in CSS manpower requirements to determine what additional adjustments were still necessary to account for selected transfers of spaces from the DISCOM to other division elements, as well as any needed adjustments (increases) to the newly designed Forward Support Battalions and their subordinate units. CASCOM labeled these adjustments "OOPS," which then increased CSS manpower requirements for the proposed FXXI IDD DISCOM from 4209 to 4329. This process and the resulting CSS manpower requirements were briefed on 3 Apr 97 to the CDR, TRADOC². It is important to note that during this briefing, CDR, TRADOC was informed that:

"...BOTTOM LINE (continued)...Enablers- (1) there are significant initiatives being developed in the areas of technology, doctrine and training. (2) Only an insignificant few will reach maturity by the establishment of the first high tech division. (3) Because of the above, there can be no major offset of requirements or reductions in strength in the near term. (4) Reduction in DISCOM strength can be accomplished over time as technology, new skill and training are developed, resources produced and assimilated into the force. And (5) until then, significant downsizing will result in an unacceptable level of risk to the FXXI Division's ability to accomplish its wartime mission."

(2) As CASCOM continued with its design of the FXXI Right-size DISCOM, the Deputy CDR, TRADOC realized the very critical role that the FXXI CSS E/I were to have associated with reductions in division-level CSS manpower requirements. Because of this, he requested that TRAC analyze the risk associated with developing and employing those special CSS technological and organizational enhancements.

b. Study Objective and Related Issues. The overall CEFA study objective was to answer the question "What are the risks associated with the FXXI CSS E/I?" The following four study issues are relevant to answering this major study objective.

Issue 1. What are the FXXI CSS E/I as approved by the CASCOM CDR?

Issue 2. What are the associated peacetime (programmatic) risks for each CSS E/I?

² CDR, CASCOM Right-size DISCOM briefing to CDR, TRADOC, 3 Apr 97.

Issue 3. What are the wartime employment risks for each CSS E/I?

Issue 4. What is the basis for assessing peacetime and wartime risk considerations?

ES-3. CEFA Methodology. Essentially this study focused on first obtaining from recent Army publications and command briefings as many identified FXXI CSS E/I as possible. This then served as the first set of "candidate" FXXI CSS E/I for review and approval by CSS proponent DCD. Concurrent with the CSS DCD's approval of their unique, proponent set of FXXI CSS E/I, they designated specific SME to be members of the CEFA study team. Using a questionnaire which addressed both peacetime (programmatic) and wartime risk factors, the study team interviewed each SME concerning his proponent FXXI CSS E/I. In preparation for completing the questionnaire, each SME was asked to query both the TRADOC and Army Materiel Command (AMC) communities for information relevant to selected risk factors. As a result of the questionnaire assessments, SME, aided by the study team, identified which of their E/I were at risk and the contributing factors. Their reviews even included, where appropriate, an analysis of the risk of selected prerequisite systems deemed important for the proper functioning of certain FXXI CSS E/I. Results of the interviews were then reviewed, analyzed and documented. It should be noted that the overall intent while assessing risks was to obtain as much "quantitative" SME input as possible, most especially in the areas of an E/I's proposed increases in efficiencies and effectiveness and proposed reductions in manpower requirements.

ES-4. Results. Results from SME-provided responses to the CEFA questionnaire were analyzed and combined to address the four primary CEFA study issues as follows.

a. Issue 1. What are the FXXI CSS E/I as approved by the CASCOM CDR?

THIS QUESTION WAS NEVER COMPLETELY ANSWERED.

From Apr-Jun 97 proponent SME developed and submitted their list of FXXI CSS E/I. Early CEFA study guidance requested that before each SME submit any candidate E/I to this CEFA and perhaps expend needless time, they first acquire their DCD's approval of each candidate E/I. Assuming DCD approval, the set of SME-provided FXXI CSS E/I formed the DCD's "candidate" set of 65 FXXI CSS E/I. They are as listed in the following Table ES 1.1.

Table ES 1.1. Alphabetical Listing of Candidate FXXI
CSS E/I (#1- #33)

1. Advanced Radiographic System (ARS)
2. Air Ambulance (UH-60Q MEDEVAC Helicopter)
3. Ammunition Solar Cover (ASC)
4. Armored Medical Evacuation Vehicle (AMEV)
5. Armored Medical Transport Vehicle (AMTV)
6. Ballistic Protection System (BPS)
7. Cargo Bed Covers (CBC)
8. Combat Service Support Control System (CSSCS)
9. Contact Maintenance Truck (CMT)
10. Container Handling Unit (CHU)
11. Container Roll In/Roll Out Platform (CROP)
12. Containerized Kitchen (CK)
13. Defense Finance Battlefield System (DFBS)
14. Digital Medical Record (DMR)
15. Digital Source Collector (DSC)
16. Driver Minder
17. Drivers Vision Enhancer (DVE)
18. Electro-Optic Test Facility (EOTF)
19. Electronic Repair Shelter (ERS)
20. Electronic Technical Manuals (ETM)
21. Explosive Ordnance Response Vehicle (EODRV)
22. Failure Analysis and Maintenance Planning System (FAMPS)
23. Finance Smart Card Interface (Software Suite)
24. Force Manning System (FMS) Module in CSSCS
25. Force XXI Battle Command, Brigade and Below (FBCB2)- CSS Functionality
26. Fork Lift Pallet Trailer (FLPT)
27. Forward Repair System- Heavy (FRS-H)
28. Heavy Equipment Recovery Combat Utility Lift and Evacuation System (HERCULES)
29. Improved Environmental Control Units (IECU)
30. Information Management Integration (IMI)
31. Integrated Combat Service Support System (ICS3)
32. Interactive Electronic Technical Manuals (IETM)
33. Laundry Advanced System (LADS)

Table ES 1.1 (Continued). Alphabetical Listing of Candidate
FXXI CSS E/I (#34- #65)

34. Life-Time Oil Filter (LOF)
35. Lightweight Disposable Dearmer (LIDD)
36. Lightweight Maintenance Enclosure (LME)
37. Load Handling System- HEMTT (HEMTT-LHS)
38. Maintenance and Repair Support System (MARSS)
39. Medical Communications for Combat Casualty Care (MC4)
40. Medical Logistics- Division (MEDLOG-D)
41. Medical Situational Awareness and Control (MSAC)
42. Modular Ammunition Company (Mod Ammo Co)
43. Movement Tracking System (MTS)
44. Multicapable Maintainer
45. Multi-Technology Automated Card (MARC)
46. Munitions Survivability Software (MSS)
47. Palletized Loading System (PLS)- Division Support Command (DISCOM) XXI [PLS DISCOM XXI]
48. Petroleum Quality Assurance System (PQAS)
49. Pocket Unit Maintenance Aid (PUMA)
50. Portable Unit Level Oil Analyzer (PUOLA)
51. Radio Frequency Tags (RF Tags)
52. Remote Controlled Reconnaissance Monitor (RECORM)
53. Remote Ordnance Neutralization System (RONS)
54. Reverse Osmosis Water Purification Unit (ROWPU)
55. Self-Contained Toxic Environmental Protective Outfit (STEPO)
56. Self- Loading/Offloading Trailer (SLOT)
57. Sensor Artificial Intelligence Communications Interactive Maintenance System (SACIMS)
58. Soldier's Portable On- System Repair Tool (SPORT)
59. Tactical Electric Power (TEP) and Associated Systems
60. Telemedicine (T-Med)
61. Test Equipment Modernization (TEMOD)
62. Transportation Coordinator's Automated Information for Movements System II (TC AIMS II)
63. Unit Ministry Team (UMT)
64. Vehicle integrated Multiple power Source (VIMEPS)
65. Warfighter Physiological Status Monitor (WPSM)

Once this complete list of 65 candidate E/I was compiled, the CASCOM CEFA coordinator had intended to staff it to the CDR, CASCOM for his review and approval. This was planned in response to CDR, CASCOM's request (which was independent of TRAC-LEE's CEFA study) that his approved list of FXXI CSS E/I be placed on the CASCOM's Internet Homepage. Such was fortuitous, as the study team had all along planned as a direct part of CEFA to also have the CASCOM CEFA coordinator staff the DCD's candidate E/I to the CDR, CASCOM. The study team desired such a review since it would have resolved selected anomalies (refer to Chapter 3, paragraph 3-2c) and perhaps eliminated certain candidate E/I from inclusion in the resulting CEFA analyses. Higher CASCOM priorities precluded the CASCOM CEFA coordinator from ever acquiring the CDR, CASCOM's review and approval of the DCD's candidate E/I. After the former CDR, CASCOM retired in Aug 97, and partially due to the fact that several of the CSS DCD's were newly assigned (normal summer rotations), CASCOM then offered to restaff the compiled list of 65 E/I back to the CSS DCD for another review. This then could have resulted in perhaps a newer/updated list of 65 FXXI CSS E/I for subsequent staffing to the new CDR, CASCOM. Given that the CSS SME (and the study team) had already expended extensive efforts in developing 65 mini-risk assessments for their DCD-approved E/I, TRAC-LEE decided against the restaffing proposal given the limited amount of study time left to bring closure on this CEFA. Rather, TRAC-LEE decided to terminate this effort and to document this CEFA as a "SNAPSHOT IN TIME."

Consequently, this Issue was never completely answered. CDR, CASCOM was never provided the candidate list of FXXI CSS E/I for review and approval.

b. Issue 2. What are the associated peacetime (programmatic) risks for each CSS E/I? The CEFA methodology resulted in derivation of a set of factors that tend to drive peacetime risk, along with assignments of peacetime risk ratings for each of the 65 candidate E/I. These are explained in paragraph ES-5c below and in detail in Volumes I and II.

c. Issue 3. What are the wartime employment risks for each CSS E/I? The CEFA methodology resulted in derivation of a set of factors that tend to drive wartime risk, along with assignments of wartime risk ratings for each of the 65 candidate E/I. The primary wartime risk factor presented by the SME was the possible lack of planned backup systems for certain E/I. These are explained in detail in Volume I (main report) and in Volume II (65 mini-assessments).

d. Issue 4. What is the basis for assessing peacetime and wartime risk considerations? The basis for most of the SME responses was their subjective military judgment (MJ). Very few responses were supported with empirical test data and/or analytical studies. This is addressed in Volume I, as well as in each of the 65 mini-assessments contained in Volume II.

ES-5. Study Conclusions and Associated Recommendations.

a. Conclusion #1. Since most of the 65 FXXI CSS E/I are estimated by SME as not being fielded by FY 10, any decisions assuming the contrary, especially those impacting reductions in manpower requirements carry risk with them.

SUPPORTING DISCUSSION:

(1) Manpower Requirements.

(a) Decrease in Manpower Requirements.

(i) Enablers (Reference Chapter 3, paragraph 3-3m). Only eight Enablers are projected to decrease manpower requirements. Division-level: (1) DSC, (2) EOTF, (3) Multicapable Maintainer, (4) MEDLOG-D, (5) ROWPU, (6) ICS3. EAD-level: (7) Modular Ammo Company, and (8) LADS. Of these eight, only five will likely be fielded by FY 10. These five are: ICS3, LADS, ROWPU, EOTF and Multicapable Maintainer. Only two (EOTF and Multicapable Maintainer) of these five belong to the FIX sub-function of the CSS Battlefield Operating System (BOS). Also, since both the LADS and the Modular Ammo Company are for EAD, any associated reductions in manpower requirements would likely not affect the Division-level. The study team was not provided any strong analytical basis to expect that the aforementioned six division-level enablers (let alone the four planned for fielding by FY 10) will total to the estimated 388 decrease in manpower requirements attributed to "anticipated increases in E/I efficiencies and/or effectiveness" (Reference Chapter 1, paragraph 1-2 c).

(ii) Initiatives (Reference Chapter 3, paragraphs 3-3g and 3-3m(4)). All the candidate initiatives were estimated to likely increase efficiencies and/or effectiveness for some CSS functions, but each by definition cannot "yet" support any decrease in manpower requirements until they are tested and proven in the field. Also, only 15 (32 percent) of the 47 total number of candidate FXXI CSS initiatives are estimated to be fielded by FY 10. Consequently, there also is little evidence to support that fielding the Initiatives will greatly mitigate (through increases in efficiencies/effectiveness) the risks associated with some of the estimated reduction of about 388 Division-level CSS personnel.

(b) Increases in Manpower Requirements (Reference Chapter 3, paragraph 3-3m). Four FXXI CSS E/I might increase manpower requirements. Phase II of the UMT will impose an increase of four requirements at the Division-level. Medical (IMI and MC4) will impose no increase at the Division-level, but may increase manpower requirements (actual numbers to-be-determined) at each Combat Support Hospital, Medical Group and the MEDCOM. Medical (T-Med) will impose no increase at the Division-level, but may increase requirements (again, actual number to-be-determined) at each Combat Support Hospital.

(2) Other Supporting Issues.

(a) By the end of the FXXI time frame (FY 10), SME estimate that only about 25 (38 percent) of the set of 65 candidate FXXI CSS E/I will be fielded (FUE). TRAC-LEE FXXI analysts estimated these 25 E/I to represent about 44 percent of the "perceived worth for indirect contributions to battlefield effectiveness." (Reference Volume I, Chapter 3, paragraph 3-3g(5).)

(b) Sixteen of the 65 candidate FXXI CSS E/I were estimated as having a "Red" Overall risk rating. None of these 16 E/I is expected to be fielded until sometime after FY 10. (Reference Volume I, Chapter 3, paragraph 3-3g(5).)

(c) By the end of the FXXI time frame (FY 10) SME estimated that only about 17 (40 percent) of the 43 E/I which rely on some form of digitization will be fielded. (Reference Volume I, Chapter 3, paragraph 3-3k(2).)

(d) Notwithstanding that most E/I are not expected to be fielded during the FXXI time frame, SME could not provide quantitative estimates of related increases in efficiencies/effectiveness. (Reference paragraph ES-5b below.)

(3) Therefore, this analysis DOES NOT TOTALLY SUPPORT the overall theme of what the CASCOM briefed to the CDR, TRADOC on 3 Apr 97. One of CASCOM's briefing charts indicated the following: (Note: The study team assumes that since this chart begins with "Enablers" and discusses in its paragraph (3) the "offsetting of requirements or reductions in strengths over time" (both unique only to the definition of "Enabler"), that the word "initiatives" in paragraph (1) and reference to "only an insignificant few" in paragraph (2) all really refer to FXXI CSS "Enablers.")

"...BOTTOM LINE (continued)...Enablers- (1) There are significant initiatives being developed in the areas of technology, doctrine and training. (2) Only an insignificant few will reach maturity by the establishment of the first high tech division. (3) Because of the above, there can be no major offset of requirements or reductions in strength in the near term. (4) Reduction in DISCOM strength can be accomplished over time as technology, new skill and training are developed, resources produced and assimilated into the force. And (5) until then, significant downsizing will result in unacceptable level of risk to the FXXI Division's ability to accomplish its wartime mission."

(a) CEFA findings do not directly support "...only an insignificant few (assumed to mean 'Enablers') will reach maturity by the establishment of the first high tech division." Rather, SME estimates indicate that about 33 percent of the proposed E and E-ORC will be fielded in time for the First Digitized Division. (Reference Chapter 3, paragraph 3-3g(2).)

(b) CEFA findings do not support "...Reduction in DISCOM strength can be accomplished over time..." (The study team assumed that "over time" means some reasonable time frame such as during the FXXI period of FY 98-10.)

(i) Enablers. The Division-level Enablers such as ICS3 (25 spaces), ROWPU (5 spaces), MEDLOG-D (9 spaces), EOTF (9 to 23 spaces), and the DSC (unknown number of spaces) might decrease around 48 to 62 spaces, not counting the DSC reductions. Also, CEFA findings related to employing the new Multicapable Maintainer do not at this time support an associated large reduction in manpower requirements. Collectively, these Enablers may not yield sufficient offsets in manpower reductions to offset the large number of manpower cuts being imposed on the new FXXI CSS force structure designs. (Reference Chapter 3, paragraph 3-3n.)

(ii) Initiatives. With respect to using anticipated increases in efficiencies/effectiveness from the Initiatives to mitigate CSS manpower cuts, SME estimates indicate that only about 38 percent of the combined FXXI CSS E/I will be fielded (FUE) by FY 10. (Reference Chapter 3, paragraph 3-3g(1).)

RECOMMENDATIONS:

(1) That HQ TRADOC and the CSS community reassess any ongoing FXXI cuts in CSS spaces attributed to planned reductions in manpower requirements due specifically to fielding the FXXI CSS E/I. These reductions are asserted to accrue from hypothesized increases in efficiencies/effectiveness attributable to fielding the new FXXI CSS E/I.

(2) That CASCOM publish a report that contains the audit trail and rationale for the decisions surrounding its new FXXI CSS redesigns. This would include where manpower cuts are proposed (a) as a result of having gone from the AOE division-level CSS organizations to the new FXXI redesigns, and (b) in anticipation of planned E/I fielding benefits.

b. Conclusion #2. "Quantification" of reductions in manpower requirements and of increases in efficiencies/effectiveness is not possible at this time for most of the candidate FXXI CSS E/I.

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraphs 3-3m and 3-3n). One of the original purposes of CEFA was to input, where appropriate, the quantitative decreases in manpower and increases in efficiencies/effectiveness for each E/I into TRADOC Analysis Center's (TRAC) Vector-In-Commander (VIC) model. Such empirical data would then be used in TRAC's Joint Venture (JV) analyses along with the new FXXI CSS structures to more accurately portray the impacts of employing new FXXI CSS concepts. However, SME responses provided extremely limited quantitative data about the E/I. In many cases SME stated it was far too early in the developmental cycle of their given E/I to permit their estimating even gross parametric ranges of likely changes to CSS manpower and/or CSS efficiencies and effectiveness.

RECOMMENDATIONS:

(1) As the candidate FXXI CSS E/I become more fully developed and tested, future CEFA-like reviews should focus heavily on obtaining "quantitative" estimates of decreases in manpower requirements and increases in efficiencies/effectiveness.

(2) When quantitative estimates of the expected E/I decreases in manpower requirements and increases in efficiencies/effectiveness are obtained, appropriate Army activities should then perform functional Manpower Authorization and Requirements Criteria (MARC) studies. These efforts would update AOE factors, thereby better representing the impacts caused by FXXI technologies and concepts.

c. Conclusion #3. The following factors contribute most to "Overall" risk: (1) inadequate funds; (2) lack of testing; (3) impacts caused by dependence on selected prerequisites; and (4) absence of one or more supporting requirements documents (Concept Statement, Mission Need Statement and Operational Requirements Document (ORD)).

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraph 3-3e). Based on the SME assessments, the aforementioned factors were estimated to drive overall E/I risk ratings. As can be seen, these factors are all peacetime issues. Certain SME also identified, to a lesser extent, the following additional risk factors: (1) the lack of planned wartime backup systems; (2) concern over possible "increases" in manpower and/or equipment; (3) unproven technical capabilities; and (4) selected other factors.

RECOMMENDATION: That proponent Directors of Combat Developments (DCD) review the Volume II mini-assessments for each of their candidate FXXI CSS E/I. They should focus on those risk drivers which they themselves control and can change. For example, if not already initiated, it may be possible that assigned Combat Development (CD) staff officers' available time can be redirected towards developing requirements documents for those E/I expected to have the high "perceived worth," or for those which are prerequisites for one or more other E/I. Existence of approved concepts, MNS and ORDs does not guarantee funding, but on the other hand their absence almost always guarantees no funding. Approval of requirement documents likely helps acquiring funds; funding likely helps the establishment of necessary testing programs to determine the adequacy of concepts and technical capabilities. Recall, Chapter 3, paragraph 3-3e indicated that the two leading primary risk drivers were inadequate funding and lack of testing.

d. Conclusion #4. Based on SME responses, five specific E/I, which ranked in the top 25 percent of all E/I in terms of their perceived worth for indirect contributions to battlefield effectiveness, will not be fielded before FY 10.

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraphs 3-3a through 3-3c and 3-3i.)

(1) These five are (1) DVE, (2) LHS, (3) CROP, (4) FRS-H, and (5) MC4, and are rated either as "Red" or "Amber."

(2) The driving risk factors for these five primarily focus on lack of funds, with MC4 also heavily dependent on "at risk" prerequisites.

RECOMMENDATION: That the DCD proponents should examine both the top and bottom 25 percent groupings of FXXI CSS E/I to determine if they have E/I in both sets which are rated other than "Green." If so, they should examine the driving risk factors of each E/I to see if they could shift resources (e.g., funds, staff officers' time) from one or more of the E/I in the last 25 percent grouping to an E/I that is in the top 25 percent grouping, AND which is not rated "Green."

e. Conclusion #5. Based on the CEFA estimate that about 60 percent of all the candidate FXXI CSS E/I entail some form of digitization, there will be a second order increase in manpower requirements in terms of computer maintenance personnel not directly reviewed in this CEFA.

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraph 3-3l and numerous Volume II mini-assessments). Some SME indicated that they thought there would likely be an increase in manpower requirements to repair the planned influx of automation equipment onto the FXXI battlefield for CSS support. SME opinions tend to be supported by the Chapter 3 finding that about 60 percent of the set of FXXI CSS E/I will employ some form of digitization.

RECOMMENDATION: If not already initiated, that the appropriate Army agency, in conjunction with the US Army Ordnance Center & School, begin a comprehensive examination of all the automation planned for the FXXI battlefield, not limited solely to CSS or even to the candidate set of FXXI CSS E/I. The objective of such a review would be to determine the amount, if any, of required increases in field maintenance personnel needed to repair automation related equipment, crucial for FXXI situational awareness and "Information Dominance."

f. Conclusion #6. The DCD-approved list (never reviewed by the former CDR, CASCOM) should be reviewed by the present CDR, CASCOM. Such action would be to review adherence to CASCOM's 7 Mar 97 definitions for FXXI CSS E/I, or to determine if changes are required to the definitions of FXXI CSS E/I. (Reference various sections throughout this CEFA report.)

RECOMMENDATION: That if CASCOM still perceives benefit in actually defining an official set of FXXI CSS E/I for review by HQ TRADOC and Headquarters, Department of the Army (HQDA), it consider institutionalizing this CEFA methodology and reviewing each of the 65 candidate E/I for adherence to CASCOM's original 7 Mar

97 definitions for FXXI E/I. Results could then serve as another analytical tool for aiding decision making in support of CASCOM's CSS Materiel Master Plan (CSSMMP) and WarFighting Lens Analysis (WFLA) reviews.

g. Conclusion #7. Based on the Systems of Systems subanalysis, CSS command and control (C2) systems and supporting battlefield communications are extremely important to the success of many other E/I, especially in the medical, maintenance and personnel areas. (Reference Chapter 3, paragraph 3-3i and numerous Volume II mini-assessments.)

RECOMMENDATIONS:

(1) That the CSS community review the advantages of defining/combining some of these E/I into one system for funding and testing purposes. The study team recognizes that certain elements of the Army community sometime think that developmental items can enjoy a better funding advantage if they are not combined. However, given the nature of the planned FXXI Army with major emphasis on situational awareness (read "the interaction of such systems as digitization, command and control, information, and communications"), continued stovepiped development of such E/I may impose unacceptable risks for the success of any one system.

(2) That, if not yet initiated, the CSS community immediately begin a thorough and holistic review of its FXXI communications requirements. Requirements resulting from this review should be included in the Command, Control, Communications and Computer (C4) Requirements Definition Program (C4RDP). C4RDP is the Army's validated source of Battle Command and Combat Support/Service Support information exchanges and C4 equipment distribution requirements.

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Chapter 1 INTRODUCTION

1-1. Purpose. This report documents the analysis performed by TRAC-LEE to assess the new FXXI CSS E/I. The purpose of this study is to provide insights into the risks associated with developing and fielding new FXXI CSS E/I, thereby providing the CDR, CASCOM with analysis to aid decision making related to mitigating E/I risks. Further, this CEFA serves as a reference document and baseline for future reviews.

1-2. Background.

a. **General.** Over about the last 20 years the US Army has gone through several force redesigns to enhance its effectiveness in the face of an ever-changing threat. In the 1970's the Army redesigned into the Division 86 structure, and then in the mid 1980's into the Army of Excellence (AOE). Now and in support of a new military strategy, severely impacted by declining budgets, the Army again is undergoing another transformation (Force XXI [FXXI]) as it prepares to move into the 21st Century.

"We are making the Army of tomorrow a reality today. We are creating a force that meets the needs of the 21st century by leveraging technology so that America can better accommodate the vastly changed geopolitical landscape."³

b. **Division 86 to Army of Excellence.** Redesigning the Army over the last twenty years has not been without risk. In Nov 90 the General Accounting Office (GAO)⁴ examined the changes the Army made when transforming from the Division 86 concept to the AOE in a report to congress entitled Army Force Structure: Lessons to Apply in Structuring Tomorrow's Army. The following three extracts from this report contribute to the "why" behind this study, and are quoted as follows:

(1) "...In the late 1970's, the Army adopted new force designs termed "Army 86" as a means of increasing the combat power of its divisions. However, by 1983, it had become clear that the new structure required so many people and so much equipment that the Army simply could not afford it. Hundreds of units were totally without people or equipment, and many others were seriously understaffed and underequipped. In the words of the Chief of Staff, the Army had become 'hollow.' In the summer of 1983, the Chief of Staff directed a total redesign of Army forces. In November 1983, the Army approved a new streamlined force structure, termed the 'Army of Excellence' (AOE) as its organizational blueprint for the future.

³ FORCE XXI, Meeting the 21st Century Challenge, Jan 95, GEN Sullivan and Honorable Togo West.

⁴ Army Force Structure- Lessons to Apply In Structuring Tomorrow's Army, General Accounting Office, Nov 1990.

In approving the new designs, the Army sacrificed some strength in both combat and support functions and accepted more risk than it had in the past. However, Army planners emphasized that this streamlined force offered a more efficient and affordable structure.”

(2) “... However, because Army planners based some key decisions on their professional judgment without adequately documenting the rationale behind them, questions continue to surface over the adequacy of the new designs (force structures)...The Army did not properly manage one major space-saving initiative- the Logistics Unit Productivity Systems (LUPS) program- which was to provide labor-saving equipment to logistical units. Because it did not ensure that these units received their required equipment and personnel and did not validate their expected gains in productivity, the Army cannot be sure that these units can perform as envisioned.”

(3) “Neither the AOE reports nor internal classified reports showed what revisions had been made to the factors used in determining personnel requirements, the basis for the changes, or the personnel savings that resulted from the changes...However, another impetus toward revising these factors was a conscious decision under AOE that the Army could afford to accept the additional risk entailed in reducing requirements for some support functions...”

Army personnel involved in the AOE study explained that some key decisions had been based on the professional judgment of task force members rather than on analytical data.

For example, decisions to reduce the number or size of a specific type of unit were sometimes based on the personal experiences of the task force members. Reductions in some support functions were made in some instances because task force members believed that requirements were inflated. Other reductions were due to the decision that, whenever possible, risks would be accepted in support functions to preserve combat capabilities.”

(4) On 24 Oct 90 the Office of the Secretary of Defense responded to the GAO report and in part indicated “... The Army of Excellence restructuring was an ambitious undertaking...Concerning the GAO conclusion that the LUPS Program was not managed effectively, the Department emphasizes that significant progress has been made in getting the program on track. The equipment issues have been resolved and some units have already been converted to the new design. Most of the funding for equipment for the remaining units has been appropriated in the FY 86 through FY 90 budgets, and the remaining funds are programmed in FY 91 and FY 92.”

c. **AOE to FXXI.** In the last several years much has been written about the Army’s current FXXI restructuring efforts. The following few quotations continue to define the “why” behind conducting this CEFA. In the FY 97 Army Science and

Technology Master Plan⁵ it cites that "...Modernization of our primary Mission Area Capability Enablers is one of the keys to dominance on the battlefield and readiness for the challenges of the 21st Century." The US Army 1996 Modernization Plan⁶ also offers interesting background. This plan reviews the Army's modernization programs and assesses their abilities to meet the Army's five modernization objectives. Its Bottom Line is highlighted below.

" We are AMBER, headed to Red. We have done the best we can with the resources provided...balancing near and future readiness. Modernization continues to be 'anemic'.. We need a stable flow of additional TOA (total obligation authority) funds to increase modernization while maintaining force structure and readiness."

In its Conclusion for Annex 1, Logistics, this plan quotes Theodore Roosevelt 'do what you can, with what you have, where you are.' It concludes that "the total Combat Service Support funding level (minus tactical wheel vehicles) unfortunately continues its downward trend. A \$832M cut from just last year was realized as of Program Objective Memorandum (POM) Lock. Though many of the programs are projected to receive increases in the out years of FY 00 and FY 01, between FY 96 and FY 99 funding is very lean. Currently, the POM forecasts a 65% overall decrement in the combat service support area between FY 95 and FY 98."

(1) Right-size FXXI Interim Division Design (IDD) Division Support Command (DISCOM). As part of the ongoing TRADOC FXXI redesign efforts, in late 1996 the CASCOM initiated a redesign of the IDD heavy division DISCOM. This effort was based on the Mar 96 TRADOC Pam 525-71, "FXXI Division Operations Concept," which served as the foundation for developing the organizational designs of FXXI divisions. The FXXI CSS concept as outlined in a Sep 96 edition of a CASCOM draft concept paper proposed a redesigned divisional CSS structure. CASCOM's Internet Home Page⁷ contains a detailed discussion of the most current FXXI Right-size DISCOM designs.

(a) Refer to Figure 1.1, AOE DISCOM to FXXI IDD DISCOM.⁸ The AOE heavy division has an approximate total of 5169 CSS manpower requirements, divided

⁵ FY 97 US Army Science and Technology Master Plan, GEN Reimer and Honorable Togo West.

⁶ The US Army 1996 Modernization Plan, HQDA Deputy Chief of Staff for Operations (DCSOPS) (DAMO-FDQ), page vii, COL Commer, 8 Mar 96.

⁷ CASCOM's Internet home page (<http://www.cascom.army.mil>).

⁸ Information shown in Figure 1.1 was obtained from CASCOM staff officers and from the CDR, CASCOM's 3 Apr 97 Right-size DISCOM briefing to the CDR, TRADOC.

between the DISCOM at 3219 spaces and the rest of the division at 1950 spaces. Due to proposed FXXI changes in CSS organizational structures and ways of performing CSS, afforded by such business practices as BD and VM, in late 1996 TRADOC restructured AOE CSS manpower spaces. This resulted in a proposed FXXI IDD DISCOM of 4209 spaces, with the rest of the IDD having only 272 CSS spaces, for a division total of 4481. At that time, CASCOM recognized that in designing the FXXI IDD DISCOM it relied heavily on future FXXI CSS E/I. This historical development is important to understanding the genesis of this CEFA. (Note: it is not within the scope of this study to document CASCOM's development of the FXXI IDD DISCOM. Such audit trail resides in internal CASCOM documents.)

(b) FXXI IDD contained a proposed decrease of about 688 division-level CSS spaces when compared to the AOE heavy division. Reduction of about 300 of these spaces was directly attributed to new maintenance and quartermaster organizational concepts and structures inherent in the new CSS designs for the FXXI IDD DISCOM. However, the other reduction in about 388 division-level CSS spaces was generally attributed to the postulated synergistic gains in efficiencies and effectiveness attributed to fielding the planned FXXI CSS E/I.

(c) In late 1996, CASCOM relooked initial reductions in CSS manpower requirements to determine what additional adjustments were still necessary to account for selected transfers of spaces from the DISCOM to other division elements, as well as any needed adjustments (increases) to the newly designed Forward Support Battalions and their subordinate units. CASCOM labeled these adjustments "OOPS," which then increased CSS manpower requirements for the proposed FXXI IDD DISCOM from 4209 to 4329. This process and the resulting CSS manpower requirements were briefed on 3 Apr 97 to the CDR, TRADOC⁹. It is important to note that during this briefing, CDR, TRADOC was informed that:

"...BOTTOM LINE (continued)...Enablers- (1) there are significant initiatives being developed in the areas of technology, doctrine and training. (2) Only an insignificant few will reach maturity by the establishment of the first high tech division. (3) Because of the above, there can be no major offset of requirements or reductions in strength in the near term. (4) Reduction in DISCOM strength can be accomplished over time as technology, new skill and training are developed, resources produced and assimilated into the force. And (5) until then, significant downsizing will result in unacceptable level of risk to the FXXI Division's ability to accomplish its wartime mission."

⁹ CDR, CASCOM Right-size DISCOM briefing to CDR, TRADOC, 3 Apr 97.

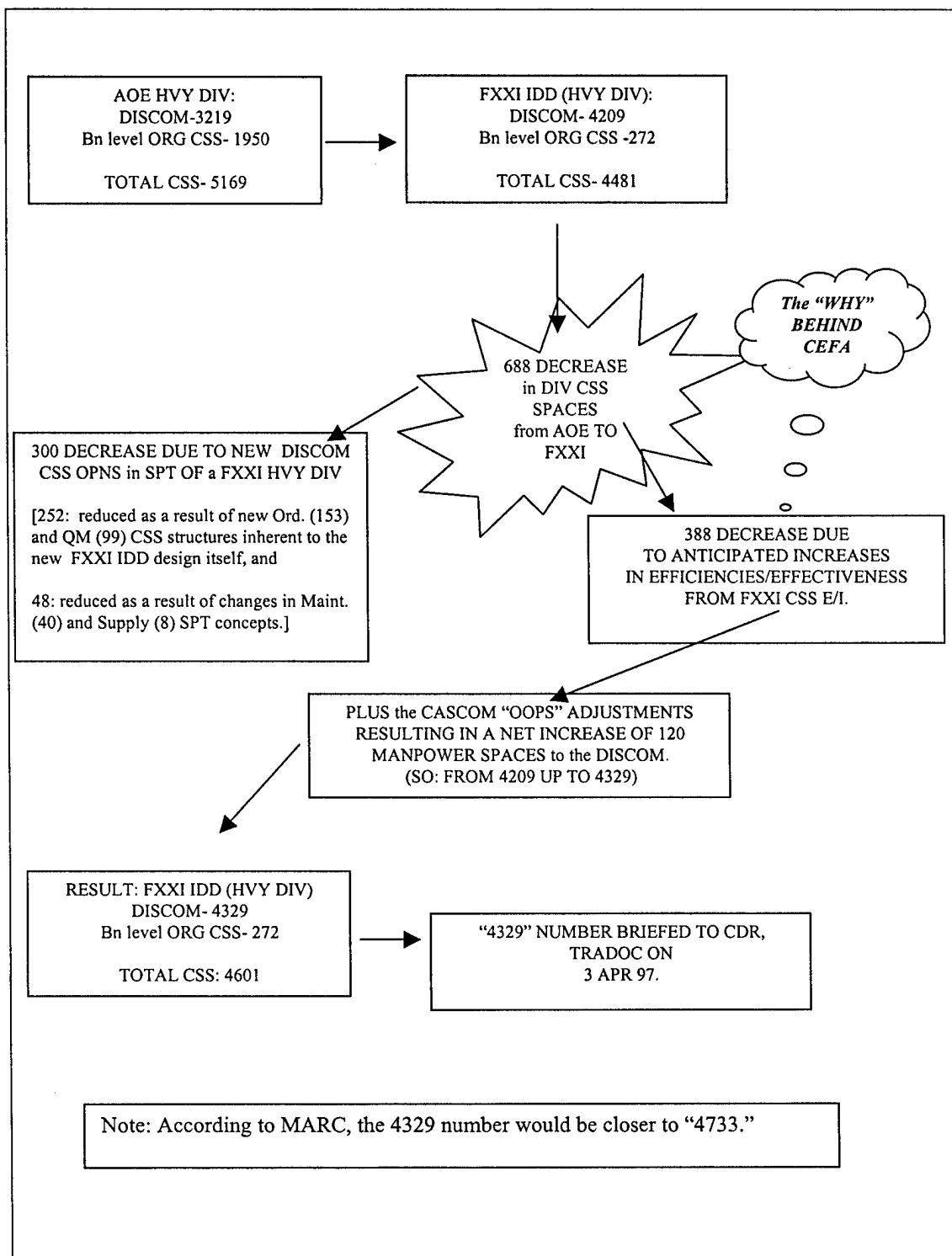


Figure 1.1. AOE DISCOM to FXXI IDD DISCOM

(d) As CASCOM continued with its design for the FXXI Right-size DISCOM, the Deputy CDR, TRADOC realized the very critical role that the FXXI CSS E/I were to have with regards to reductions in division-level CSS manpower requirements. Because of this, he requested that TRAC analyze the risks associated with developing and employing those special CSS technological and organizational enhancements.

As mentioned earlier, the 1990 GAO report revealed that "...Army personnel involved in the AOE study explained that some key decisions had been based on the professional judgment of task force members rather than on analytical data. For example, decisions to reduce the number or size of a specific type of unit were sometimes based on the personal experiences of the task force members..."

(2) FXXI CSS Analyses. During FY 97 and presently continuing into FY 98, CASCOM explored the feasibility of several other division-level CSS structures. The CSS impacts of both the IDD and these other designs are examined as a part of another TRAC set of FXXI analyses entitled Division Design Analysis (DDA) Phase I, II, and III.¹⁰ The extent to which these other analyses explicitly considered the FXXI CSS E/I will be addressed later in this study. TRAC-LEE's CSS JV Capstone Analysis will integrate results from the DDA, this CEFA, and other TRAC-LEE FXXI CSS analyses, and answer the critical question "Does the FXXI CSS concept, structure, and systems support the FXXI operational concept." This CEFA supports the CSS JV Capstone Analysis study effort. CEFA examines those FXXI CSS E/I materiel and organizational changes deemed necessary to offset the almost certain reductions in CSS manpower requirements inherent in the new FXXI division CSS Redesign.

1-3. Study Objective and Essential Elements of Analysis (EEA). The overall CEFA study objective is to answer the question "What are the risks associated with the FXXI CSS E/I?" The following four EEA are relevant to answering this major study objective.

a. EEA.

- (1) What are the FXXI CSS E/I as approved by the CASCOM CDR?
- (2) What are the associated peacetime (programmatic) risks for each CSS E/I?
- (3) What are the wartime employment risks for each CSS E/I?
- (4) What is the basis for assessing peacetime and wartime risk considerations?
(Reference the aforementioned 1990 GAO report for background)

b. Sub EEA questions are those contained in the CEFA questionnaire, which was used as the basis for interviewing CSS SME.

¹⁰ Division Design Analysis (DDA) Phase I, II, and III, Jan-Sep 97, TRAC-SAC, Ft Leavenworth, KS.

(Reference Chapter 2 and Appendix C for descriptions of this questionnaire).

1-4. Scope. The CEFA focused on the above study EEA in the context of the following.

a. FXXI has as its objective the transformation of the force (Army) to a knowledge and capabilities based, power projection Army, capable of land force dominance, across a continuum of 21st Century Military Operations.¹¹ FXXI has three distinct development axes; i.e., (1) Institutional axis [Title 10 responsibilities, Missions and Functions and redesigning the Table of Distribution and Allowances (TDA) Army], (2) JV axis [Designing the Division XXI, Applique Division 2000, Applique Corps by FY 06, conduct of supporting Army Warfighting Experiments (AWE), and the development of related Organization and Operation (O&O) plans], and (3) Acquisition/Assimilation axis (focus on acquisition reform, digital information and technology). An article entitled "Leveraging Logistics Technology FXXI"¹² explained that logistics initiatives are being formulated across all of these three FXXI axes. This article described some of the key initiatives that "leverage the technologies of information to improve and increase logistics enablers." The logistics initiatives discussed included:

- (1) Digitized Technical Manuals
- (2) Total Distribution Program
- (3) BD
- (4) Single Stock Fund
- (5) Integrated Sustainment Maintenance
- (6) Predictive Readiness Indicators
- (7) Logistics Support Element
- (8) Wholesale Logistics Infrastructure
- (9) Computer-Aided Acquisition and Logistics Support (CALS)
- (10) Acquisition Streamlining
- (11) Strategic Mobility
- (12) Prepositioned (PrePo) Afloat
- (13) Logistics Civil Augmentation Program (LOGCAP)
- (14) Force Provider
- (15) Field Feeding
- (16) Ration Support
- (17) Demonstrated Soldier Systems

Since TRADOC is responsible only for the JV axis of FXXI, and since the origination of this effort was linked to CASCOM's FXXI IDD Right-size DISCOM restructuring, this

¹¹ Article entitled "Force XXI to Army XXI, Synergy for the Next Century", co-authored by GEN Hartzog and Susan Canedy, Association of the US Army (AUSA) Symposium Issue, May 96.

¹² Article entitled "FXXI, Leveraging logistics Technology toward FXX", co-authored by LTG Wilson and Mr. Robert Capote, Army Logistician, Jul-Aug 95.

CEFA focuses only on those JV CSS E/I planned for the FXXI Division, Corps and Theater.

The aforementioned CSS E/I are exemplary in nature and presented in recognition of the fact that there are other CSS E/I that are outside the scope of this effort. The actual list of the official FXX CSS E/I for examination by this CEFA was to be determined by the CASCOT and its associated CSS DCD. Development of this critical list and its subsequently planned approval by the CDR, CASCOT will be discussed in detail in Chapter 2.

b. During the conduct of this CEFA, several study parameters were established which will be further discussed in Chapter 2. One such key parameter pertinent to the study scope was that the wartime risks and associated threats were those which CSS SME understood as existing within the framework of current FXXI planning scenarios.

1-5. Constraints/Limitations.

a. **CEFA is a "SNAPSHOT" in time.** This CEFA and its findings are limited to the information obtained from CSS SME during Apr-Jun 97. Information provided the study team often was time sensitive and in some cases needed clarification among responding SME. Funding information and data to be gained from upcoming tests were often not available. Due to resource constraints, updating of the data once collected was not possible.

b. **Absence of any written CEFA Study Tasker.** This analysis was constrained by the lack of command emphasis. No HQ TRADOC written tasker was ever issued for conducting this CEFA. Consequently, it was *immensely difficult* for the study team to negotiate a priority for obtaining required support from within the TRADOC CSS community at large. Everyone was extremely busy and each agency had its own established high-priority actions and studies. With extremely scarce resources available to do many different things, some SME responding during Apr 97-Jun 97 could provide only a very small amount of their time to answering the CEFA risk questions for their given CSS E/I. In some cases SME who initially responded were replaced by different SME who then finalized their proponent assessments(s). These replacement actions were due to many different reasons, to include higher internal priorities and even changes in duty locations.

c. **SME Demographic Data.** Due to the above issues and to the fact that many SME had extremely limited time available to participate in CEFA interviews, the study team made no attempt to ask SME to complete a second questionnaire for capturing demographic/personal data. If obtained, this data could later have been used to describe the sample of SME respondents.

d. **Quantitative Estimates of Increases in E/I Efficiency and Effectiveness and Decreases in Manpower Requirements.** Within the spirit of the 1990 GAO critique of

the Army's AOE redesign efforts, it was the original intent of this CEFA to acquire as much quantitative information as possible to support SME individual risk assessments. Of specific interest was the acquisition of quantified estimates (ranges) of (a) increases in efficiencies/effectiveness, and (b) decreases in manpower requirements attributable to fielding a given CSS FXXI E/I.

However, many of those items designated by the CSS community to be FXXI CSS E/I, and therefore candidates for this CEFA, are in the early stages of development. Consequently, many of the SME simply could not provide quantitative answers.

As to be discussed later, many SME were also reluctant to provide even "subjective ranges of estimates" for increases in efficiencies and effectiveness and/or for decreases in manpower requirements. In some cases, however, the study team thinks that quantitative support for provided responses was available, perhaps from the Army Materiel Command (AMC)/Project Managers (PM) organizations as part of their Integrated Logistics Support (ILS) reviews. However, time and priorities did not permit the responding SME to locate such information. In most cases, SME provided answers concerning increases in efficiency and effectiveness and/or decreases in manpower requirements based solely on their military judgment (MJ) and personal experiences. The study team accepted such responses in the absence of any supporting quantitative data. The study team does not know what percent of the SME responses could have actually been based on fact and quantified versus based on SME-MJ.

1-6. Clarification of Certain SME Input Data. After review by the study team, a few selected SME CEFA responses needed subsequent clarification and/or may have been in conflict with a response provided by another SME. Within the backdrop of the above study constraints and limitations, the study team did not have the resources to deconflict certain anomalies pertaining to a few of the SME responses. In many of those cases, the study team used its own MJ, made certain assumptions which are documented herein, and provided a tentative response or indicated "Unknown"; thereby allowing this effort to proceed. In consideration of all of the above, the study team has conducted many Army analyses and is of the opinion that this CEFA is based on reasonably robust information, and can be used to develop insights as to the overall magnitude and direction related to the risks for those FXXI CSS E/I identified herein.

1-7. Assumptions.

a. Individual SME Risk Aversion. The insights derived from this analysis are based on each responding SME's own personal risk aversion (and in some small part on that of the study team). It is conceivable that for a different set of respondents a different assessment of risks could have been obtained. However, it was assumed that the responding SME represented a reasonable cross section of current military risk takers/risk avoiders. As requested in the original Jan-Feb 97 TRAC-LEE CEFA methodology guidance, all SME responses were to have represented the position of their respective

DCD. Therefore, this study assumed that SME responses represent the official position of their respective DCD.

b. SME FXXI Qualifications. As discussed above, the study team assumed that each SME's assessment for his particular E/I represented the position of his DCD. The study team also assumed that since their DCD named them to represent their organization, each SME was qualified in TRADOC Combat Developments (CD), in their own functional area, and versed in ongoing FXXI CSS organizational procedures and designs.

c. FXXI CSS E/I. As discussed in detail in Chapter 3, each FXXI CSS E/I approved by its proponent CSS DCD was assumed to have functionally unique "inherent worth for indirectly contributing to battlefield effectiveness." Consequently, for purposes of this study each E/I was assumed to represent reasonably independent methods for CSS proponents to obtain their requisite Functional Operational Capabilities.

1-8. Overview of this Report. Chapter 2 presents the CEFA methodology used for analyzing the FXXI CSS E/I. The findings of this assessment are reviewed in Chapter 3, with Chapter 4 containing study Conclusions and Recommendations. Report appendices contain varied supporting documentation, with Volume II containing the individual risk assessments for each of 65 designated FXXI CSS E/I.

METHODOLOGY

2-1. General Study Methodology. As an overview, the general methodology developed to conduct this assessment consisted of 11 basic tasks as shown in Figure 2.1.

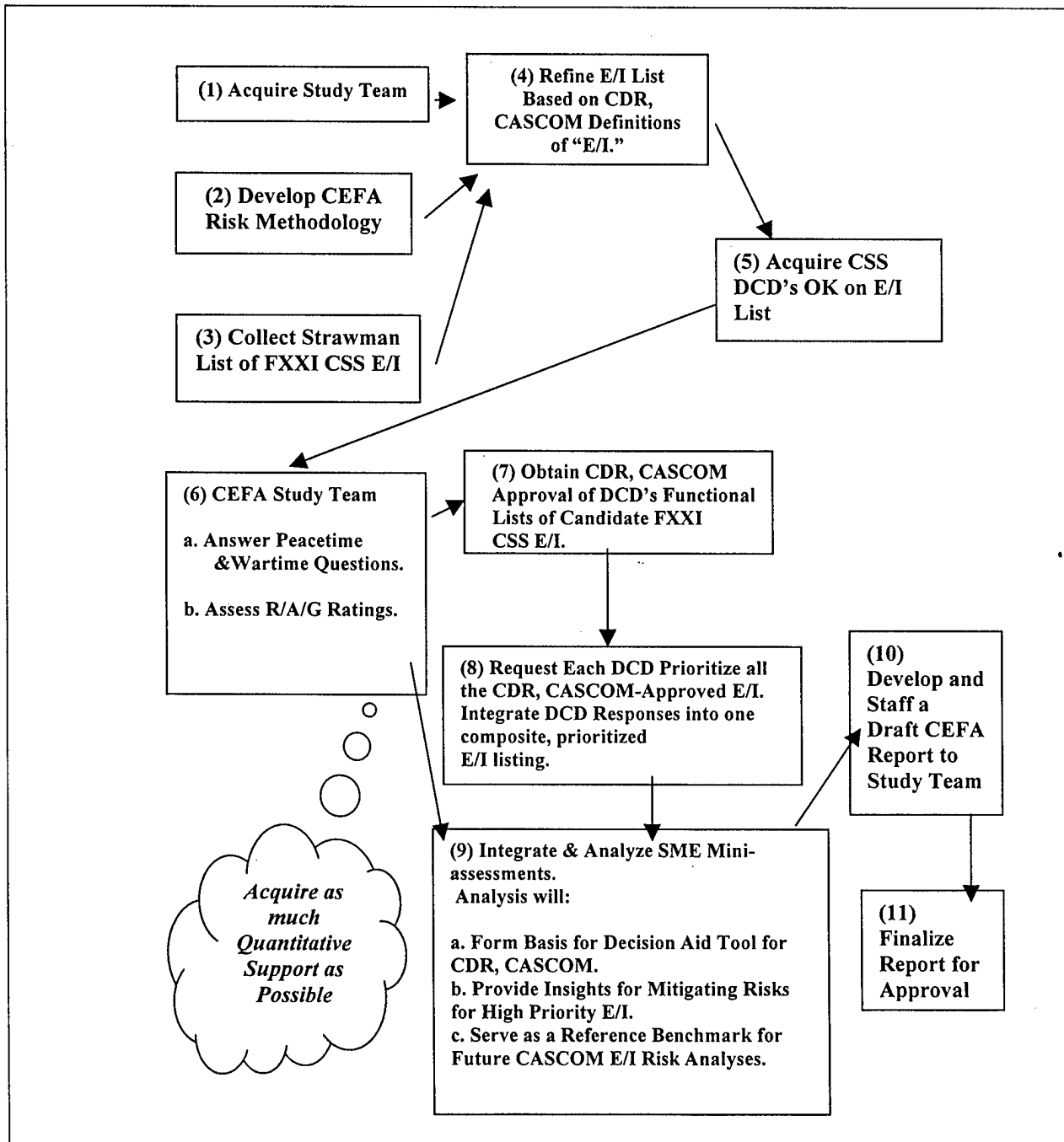


Figure 2.1. General Study Methodology

a. Essentially this study focused on first obtaining from recent Army publications and command briefings as many identified FXXI CSS E/I as possible. This listing then served as the first set of "candidate" FXXI CSS E/I for review by proponent DCD. Each DCD designated specific CEFA SME who advised the study team that their DCD had reviewed the initial E/I list for additions and deletions. This resulted in a "DCD-approved" set of candidate E/I for a then planned subsequent review by the CDR, CASCOM. While planning to obtain CDR, CASCOM approval of each DCD's candidate E/I, the study team initiated individual SME E/I risk assessments. Through the use of a questionnaire which addressed both peacetime (programmatic) and wartime risk factors, the study team interviewed each SME concerning his proponent FXXI CSS E/I. In preparation for completing this questionnaire, SME were in advance to query both the TRADOC and AMC communities for information relevant to their E/I. As a result of the questionnaire assessments, SME then identified various factors estimated to contribute to the risk associated with their proponent E/I. These factors even included an analysis of the risk of selected prerequisite systems deemed important for the proper functioning of some given FXXI CSS E/I. Results of the interviews were then analyzed and documented.

b. As stated earlier in Chapter 1, the overall intent while assessing risks was to obtain as much "quantitative" SME input as possible, most especially in the areas of an E/I's proposed increases in efficiencies and effectiveness and/or proposed reductions in manpower requirements.

The following paragraphs provide detailed explanations of each of the individual 11 study tasks.

2-2. Acquisition of a CEFA Study Team (Task #1). This CEFA was conducted and led by a TRAC-LEE analyst with support from personnel from within the CASCOM, Adjutant General (AG) School, Finance (FI) School, Chaplain School, Judge Advocate General (JAG) School, and the US Army Medical Department Center & School (AMEDDC&S). DCD from these activities designated SME to respond to the CEFA questionnaire. In addition to assigning SME to respond to specific E/I, CASCOM also provided an analyst, part time, to assist TRAC-LEE with overall coordination of study tasks throughout the CSS community. However, within this study report the use of the phrase "the study team," in relationship to analyzing the SME-provided E/I assessments, generally refers to TRAC-LEE personnel. It should be noted that Volume II contains the individual CEFA risk assessment for each of 65 identified FXXI CSS E/I. Paragraph 45 of each assessment identifies the primary responding SME for any given E/I.

2-3. Develop the CEFA Risk Methodology (Task #2). The CEFA risk methodology was driven primarily by a questionnaire aimed at acquiring SME-provided peacetime and wartime risk assessments for each FXXI CSS E/I.

a. AOE Questionnaire. In the early 1980's the US Army Logistics Center conducted a subjective risk assessment of selected CSS productivity enhancements that

were planned to offset the then proposed AOE reductions in division-level CSS. This former methodology focused around the use of a questionnaire, and requiring proponent CSS SME to subjectively assess selected programmatic and wartime risk factors relating to the successful fielding of their AOE CSS initiatives.

b. FXXI Questionnaire. Using a similar but more comprehensive approach, the study team developed a questionnaire which aimed at collecting information concerning both peacetime (programmatic) and wartime employment information as it related to each candidate FXXI CSS E/I. These specific elements of information when taken collectively were considered to be indicators of either programmatic or wartime risks and are briefly discussed below.

However, the reader of this CEFA is strongly urged to review Appendix C to gain a full understanding of the meaning and intent of each CEFA question.

(1) Section I of the questionnaire pertained to E/I descriptive information, as well as other information from recent Army actions (relevant reviews by HQDA ODCSOPS [in the 1996 Army Modernization Plan], HQ TRADOC's Jan 97 WFLA briefing to HQDA, CASCOM's Sep 96 CSSMMP) that would collectively serve as background. Included in Section I are the following questions.

- Title of the E/I?
- Designation (I, E, E-Offset Required Capability)?
- Doctrine, Training, Leadership, Organization, Materiel, and Soldiers (DTLOMS) area impacted?
- E/I type (Digitization, Modernization or Both)?
- CSS Battlefield Operating System (BOS) function impacted?
- Already established FXXI priority for this given E/I?
- CASCOM's Sep 96 CSSMMP priority for this E/I?
- Jan 97 HQ TRADOC's WarFighting Lens Analysis (WFLA) funding recommendations to HQDA for this E/I?
- The 1996 Army Modernization Plan's statements of risk for the given E/I?

(2) Section II of the questionnaire addressed various peacetime (programmatic) factors that individually or collectively could provide insights into the programmatic risk status of the given E/I. Each SME was asked to assign a programmatic risk rating of Red, Amber or Green for his given E/I, based on his responses to the following questions.

- Critical prerequisites needed for the given E/I? What are the adverse programmatic risks, if any, on the E/I if these prerequisites are not fielded?

- What other FXXI E/I require this given E/I in order to function? What are the adverse programmatic risks, if any, on these other FXXI E/I if the given E/I is not fielded?
- What other FXXI E/I will "benefit" (read "different than require") by fielding the given E/I?
- Supporting analytical studies?
- Changes in force structure requirements (manpower, equipment and organizations) attributable to fielding the given E/I?
- Changes in efficiencies/effectiveness attributable to fielding the given E/I?
- Status of E/I's Operational Concept, MNS, ORD and Basis of Issue Plan (BOIP)?
- Status of TRADOC school house training for the E/I?
- Examined in TF XXI Advanced Warfighting Experiments (AWE), TRAC's DDA studies, and the Division AWE?
- Tested elsewhere and results?
- Funded in the FY 98-03 Program Objective Memorandum (POM) and in the FY 04-2012 Extended Planning Program (EPP)?
- Planned BOIP connectivity between Force Packages?
- Technical capabilities proven?
- Operational Test and Evaluation Command's (OPTEC) Integrated Logistics Support (ILS) risk assessment for the E/I?
- Fielding schedule in time for the First Digitized Division/Corps?
- SME-provided peacetime risk assessment based on the above factors?

(3) Section III of the questionnaire addressed a limited number of factors relating to wartime employment of the given E/I. Each SME was asked to assign a wartime risk rating of either Red, Amber or Green for his given E/I as based on his responses to the following questions.

- Likelihood of the given E/I's performance being degraded in wartime due to threat; Reliability, Availability and Maintainability (RAM) failure; or lack of sufficient supporting force structure?
- Likelihood of any prerequisite's wartime degradation?
- Existence of any planned backup system?
- Adverse impact if the given E/I is degraded with/without any backup system in place?
- Adverse impacts due to limited fielding of the given E/I?
- Other adverse wartime employment factors (e.g., scenario dependent)?
- SME-provided wartime risk assessment based on the above factors?

(4) Section IV of the questionnaire contained an SME-assigned overall risk rating for his E/I taking into consideration his above programmatic and wartime risk assessments. This section also contains entries for any SME remarks/information deemed appropriate, as well as the name and DSN of the responding SME.

(5) CEFA Microsoft ACCESS database. For most of the CEFA questions, the sets of possible type responses were devised in such a manner as to facilitate entry into a Microsoft ACCESS data base developed by the Advanced Engineering and Planning Corporation, Inc. (AEPCO). This CEFA database was constructed using Microsoft ACCESS database software Version 8. The data base consisted of one data table, one date entry and modification form, one startup form with linked menu options, and a report form for total record report. It had 45 main data fields (refer to Appendix C, CEFA questionnaire), several of which had sub-fields to record additional data as needed. The data entry form used list boxes for selection of repetitive data entries to reduce errors and simplify the data entry process. The data base, working in conjunction with Microsoft Word Version 7 template, was capable of producing individual Word documents for each data record. Each document produced could be edited using Microsoft Word to generate report documents as needed. ACCESS is capable with data filters of selecting only specific data for viewing, reporting and printing. The software also supports the use of structured query language to retrieve, print and report responses to specific data requests. This ACCESS data base is available upon request to TRAC-LEE to individuals desiring to do tailored reviews beyond those already presented in Chapter 3, Findings.

2-4. Collect Strawman List of FXXI CSS E/I (Task #3). In an effort to develop an initial starting point for this review, the study team reviewed many Army documents which discussed FXXI and different FXXI E/I. Appendix A contains a listing of each of the references used to develop the initial strawman CEFA list of candidate FXXI CSS E/I. As a result of the literature search, approximately 160 items were identified as possible candidate FXXI CSS E/I. However, during the review of this literature it became very apparent to the study team that there was absolutely no consensus within the Army community on the definition of FXXI "Enabler" or "Initiative," or even what the JV CSS subset was. The following highlights selected quotes taken from a few different sources. The study team notes that in fairness to each agency, they each applied their own definitions to fit the context of their discussion points.

a. Army Focus 94¹³ reads in part on page 23 "...FORCE XXI ...In his fiscal year 1995 posture testimony before congress, General Gordon R. Sullivan cited five 'enablers' which enhance the Army's ability to project power to any part of the world in a short period of time. These enablers are quality soldiers and civilians, access to the National Guard and Army Reserve, a modernized force, strategic mobility, and a trained and ready force." Obviously GEN Sullivan was addressing FXXI Enablers from a national and global point of view.

¹³ Army Focus 94, America's Army in the 21st Century, GEN Sullivan ,CSA, and the Honorable Togo West, Secretary of the Army, Sep 94.

b. Army Logistician article entitled "FORCE XXI- Leveraging Logistics Technology Toward FXXI"¹⁴ reads on page 14 "... Logistics initiatives...are being formulated, implemented, and executed successfully. Let us describe some of the ongoing key initiatives that leverage the technologies of information to improve and increase logistics enablers." The article then goes on to describe 17 logistics initiatives. One could infer from this article that selected "initiatives" improve or increase other logistics "enablers."

c. HQ TRADOC pamphlet entitled "FORCE XXI- Land Combat in the 21st Century"¹⁵ contains a description of FXXI concepts, enablers and technology. For the sustainment area, it lists the following six "enablers": Integrated Maneuver and CSS/Personnel Services Support (PSS) Command and Control, Total Asset Visibility, Modular Organization, CSS Control System (CSSCS), Movement Tracking System (MTS), and Wireless Standard Theater Army Management Information Systems (STAMIS).

d. In Sep 96 CASCOM published its CSS MMP¹⁶. In its Introduction section it states that "This plan documents the Army's CSS materiel requirements to resolve current deficiencies and implement the long-term goals of FXXI. These are the near-, mid-, and long-term 'enablers' needed to achieve required operational capabilities, implement future concepts, and exploit technological opportunities. These initiatives overcome current deficiencies, facilitate goals of power projection, and anticipate the opportunities and challenges of the emerging FXXI CSS concept of Battlespace Logistics... It (the CSSMMP) includes all CSS materiel and automation initiatives under development, emerging from 'experimentation,' programmed for continued fielding, and anticipated as replacement or upgrades." This plan contains over 90 such "enablers."

e. In Oct 96 the TF XXI 4th ID Experimental Control Cell (ECC)¹⁷ identified 41 items as CSS "enablers." The ECC also defined a CSS "enabler" to be "...equipment, concepts that may reduce personnel, increase efficiency, and or increase effectiveness. They (enablers) may support a concept."

f. A CASCOM Nov 96 email¹⁸ reads in part "...The key enablers ...for PROJECT and SUSTAIN are: Total Asset Visibility, Modular Organizations, Prepositioned Equipment, Integrated Logistics Automation, CSSCS, MTS, and Wireless STAMIS."

¹⁴ Army Logistician article entitled "FORCE XXI- Leveraging Logistics Technology Toward FXXI", LTG Wilson and Mr. Capote, Jul-Aug 95.

¹⁵ HQ TRADOC pamphlet entitled "FORCE XXI- Land Combat in the 21st Century, GEN Hartzog, 1996.

¹⁶ CASCOM CSS Materiel Master Plan (CSSMMP), Sep 96.

¹⁷ TF XXI CSS Enabler Matrix, 4th ID Experimental Control Cell, Oct 96.

¹⁸ CASCOM (DCD-CSS Integration Dir) 15 Nov 96 email, subject: WFLA Reclama.

g. Revolution in Military Logistics¹⁹ reads on page 2 "...Focused logistics and a distribution-based logistics system are the enablers..."

h. CASCOM briefing slide (dated o/a Feb 97) relating to "What We Are Doing to Modernize" indicated for Army XXI "Common Enablers ... Assured Communications, Doctrinal Changes, Technology Enhanced Systems (embedded sensors, CSSCS with Integrated Command, Control and Computer System [ICS3], Warfighter Information Network [WIN], Neural Net, MTS, TeleMedicine, and others), Theater Medical Information Program, Acquisition Reform, and Performance Metrics Set."

i. In Jan 97 the study team queried HQ TRADOC for the existence of official definitions of "enabler" and "initiative" which could be used for FXXI/JV analyses. HQ TRADOC advised that no such definitions existed. Consequently and in a large part due to the varied interpretations placed on these two words by the Army community, the study team postulated the following strawman definitions. They were specifically written as catalysts to provoke thought and discussion, with the hope of acquiring an agreed upon set of definitions for use in this CEFA.

(1) Initiative. A system or concept for fielding and/or experimentation. It will be a combat multiplier keyed to DTLOMS. An initiative may be dependent on one or more enablers.

(2) Enabler. A recent technological development planned for fielding during the FXXI time period (FY 98-FY10). Generally speaking some FXXI initiatives are "enabled" by one or more enablers. (Note: enablers do not necessarily require an increase or decrease in force structure.)

These strawman definitions were provided to the CASCOM, AMEDDC&S, JAG, AG and FI Schools with the request that they be changed in any way that these agencies felt appropriate.

j. With CASCOM concurrence, in Feb 97 the study team briefed²⁰ HQDA ODCSOPS personnel on the planned CEFA methodology. The study team provided a consolidated review of the various types of candidate FXXI CSS E/I, as compiled from the Appendix A sources, and as scoped to reflect the JV subset of FXXI (refer to Chapter 1, paragraph 1-4. Scope). This briefing showed approximately 160 items as possible E/I candidates, and listed them under the category identified by their respective sources. During this briefing, the aforementioned strawman definitions were also discussed. The study team was then advised by HQDA personnel that they tended to equate the term "enabler" with definite reductions in CSS manpower requirements.

k. Within a few days after having been briefed by the study team (late Feb 97) HQDA ODCSOPS advised CASCOM that they were not aware that the CSS community

¹⁹ Revolution in Military Logistics, Feb 97, LTG Coburn, Feb 97.

²⁰ TRAC-LEE CEFA briefing, Feb 97, Mr. Jim Behne.

had so many candidate "enablers" (i.e., a possible source for taking reductions in manpower requirements). This was due in large part to the fact that in its literature search phase the study team uncovered many items as having been identified as CSS "Enablers." Consequently and in a large part as preparation for an upcoming 3 Apr 97 FXXI Right-size DISCOM briefing to the CDR, TRADOC, on 7 Mar 97 the CDR, CASCOM published the following definitions to be used for CASCOM's Right-size DISCOM restructuring efforts. The following include an understanding as discussed in many internal CASCOM meetings that if a CSS item had its First Unit Equipped (FUE) date before FY 98, then generally speaking, it should have been excluded from being designated a FXXI E/I.

(1) Initiative (I). A DTLOMS change for which there is currently no associated force structure reduction. Initiatives may transition to enablers as they are funded/resourced within a target window of consideration...FXXI- by FY 10, etc., reach maturity and demonstrate significant savings as to allow consideration for force structure savings.

(2) Enabler (E). A DTLOMS change (equipment, organization, concept/doctrine, etc.) that when fielded demonstrates/promises sufficiently increased efficiency in operation as to allow reductions in force structure, or offsets required capabilities that are currently unresourced (E-ORC). Note well: the primary intent of this definition was to focus on reductions in "manpower requirements." However, as written, if an item only reduced equipment requirements, it was open to also being defined as an "Enabler." This did in fact happen in this study. Therefore, the reader is advised to not always link the term "Enabler" solely to reductions in manpower requirements.

These definitions became the official definitions for use by this CEFA. Throughout this report documentation "E" is used generically to represent either an enabler (E), or an enabler which offsets required capabilities that are currently unresourced (E-ORC). Chapter 3, Findings, will specifically differentiate those enablers which were designated "E" versus those designated "E-ORC."

2-5. Refine the strawman list of candidate E/I as based on the CDR, CASCOM's 7 Mar 97 definitions for FXXI CSS E/I, and acquire proponent DCD's approval (Tasks #4 and #5). The strawman list (task #3), developed by the study team, of approximately 160 candidate "FXXI CSS E/I" was reviewed by proponent DCD (within (a) CASCOM: DCD-Ordnance Directorate, DCD-Transportation Directorate, DCD-Quartermaster Directorate, DCD-CSS Integration Directorate, Director-Information Systems Directorate, and the TRADOC Systems Manager (TSM) for CSS Control System (CSSCS); (b) AMEDDC&S, (c) FI School, (d) AG School, and the (e) JAG School). Each Director was asked to focus on his own proponent functional area; and using the CDR, CASCOM's 7 Mar 97 definitions for a FXXI CSS E/I, to either add or subtract his candidate E/I from the strawman list. The resulting master list represented a DCD-approved compilation of candidate FXXI CSS E/I for subsequent assessment by their designated SME.

2-6. Within their individual functional area, the CEFA study team (primarily the DCD-designated SME) assessed the peacetime (programmatic) and wartime risks for each candidate E/I using the CEFA questionnaire (Task #6).

a. The study team interviewed every CEFA SME, primarily in person but some telephonically, and obtained written or oral answers to the CEFA questionnaire. Based on their responses relating to peacetime (programmatic), wartime employment, and overall E/I risk factors, SME also subjectively assigned risk ratings (Red, Amber, or Green) for their respective E/I. Refer to Appendix C for a complete explanation of the CEFA questionnaire construction and the factors used to assess risk. For purposes of this CEFA, "risk" was defined as follows.

(1) **Peacetime risk:** A subjective assessment of the magnitude of the problems associated with the programmatic issues for fielding a given E/I (e.g., development and/or approval of relevant requirements documents, ILS issues, testing, firm plans/funding to field the E/I within the FXXI time frame (FY 98-10), and where appropriate the programmatic risks related to any "prerequisite" systems deemed critical for fielding the given E/I). Risk ratings of Red, Amber or Green derived from AR 700-127 (Integrated Logistics Support) were then assigned. They are defined as follows.

(a) **Red:** Significant problems with no solutions identified, or a solution being implemented with less than satisfactory results projected by the next major milestone.

(b) **Amber:** Significant or minor problems identified, with a solution or work-around plan expected to be completed by the next major milestone date.

(c) **Green:** No problems.

(2) **Wartime risk:** A subjective assessment of the magnitude of the problems associated with both the likelihood that a given E/I may fail on the battlefield and the adverse wartime impacts resulting from such failure. The above Red, Amber and Green definitions apply.

(3) **Overall risk:** A subjective assessment of the magnitude of the overall (peacetime and wartime) risk associated with a given E/I. The above Red, Amber and Green definitions apply. CEFA study guidance established the overall risk rating to be the worse case situation considering both peacetime and wartime risk ratings. (Note: No attempt was made to quantify and assign "individual weights of importance" for any one risk factor, or to quantify the interdependence of one factor to another.)

b. Peacetime, Wartime and Overall assessments of risk also considered the interrelationships of a given E/I to any necessary "prerequisite." For purposes of this CEFA, "prerequisite" was defined as anything deemed essential or critical to a given E/I for performance of its intended mission."

Discussion.

(1) Consider the analogy of the human body. It has arms, legs, a heart, eyes, and many other organs. A functioning heart is clearly a “prerequisite” in the strictest sense. But eyes and limbs can be considered by some to also be “prerequisites” in the sense that they are needed for the body to “realize its full potential.” At the start of this CEFA the intent was that a prerequisite was analogous to the body’s heart. However, as the study evolved it became apparent that most if not all of the E/I have many diversified sub-components and sub-functions, that when viewed collectively define the E/I.

(2) In this context, some E/I have sub-components that are essential and can be classified as prerequisites (read “prerequisite” for the E/I to “realize its full synergistic potential;” e.g., individual prerequisites needed for medical situational awareness and for maintenance situational awareness). Therefore, most E/I have no “prerequisite” in a fashion analogous say to the relationship that the heart has to the rest of the human body. The study team thinks that if in fact there were any such items deemed so critical (read: “prerequisite” analogous to the heart of the body), then these critical items would likely be considered as part of the integral definition of the E/I itself.

(3) Most of the E/I have no critically required item that would cause the E/I to be of no absolute benefit to the commander. Even without fully operational battlefield communications, many SME thought that their E/I would still be able to provide some benefits within their own functional area of operation and to those commanders located immediately nearby the E/I itself.

(4) The definition of a “prerequisite” and its subsequent interpretation by many SME became a contentious issue as the CEFA study matured. Most SME opted to interpret “prerequisite” as that which is critical for an E/I to “realize its full synergistic battlefield potential” and not in a fashion analogous to the relationship that the human heart has to the body.

c. In a few cases, after review by the study team, selected SME CEFA responses needed subsequent clarification and/or may have been in conflict with a response provided by another SME. Within the backdrop of the Chapter 1 study constraints and limitations, the study team did not have the resources to deconflict certain anomalies pertaining to a few of the SME responses. In many of those cases, the study team used its own MJ, made certain assumptions which are documented herein, and provided a tentative response or indicated “Unknown.” Answers were then reviewed for consistency, documented in individual E/I “mini-assessments,” and analyzed for this study effort.

Refer to Volume II for each of these mini-assessments.

(Note: When formulating and documenting each assessment, the study team primarily used information as provided directly from the responding SME. However, the study team frequently injected information of its own, and in some cases provided a different opinion. The study team made every effort in each assessment to place this extra information inside brackets such as “[...]” As a result, the reader will be able to differentiate SME-provided information from that derived by the study team.)

2-7. Obtain CDR, CASCOM’s approval of DCD’s functional lists of candidate FXXI CSS E/I. Then request each DCD prioritize all the CDR, CASCOM-approved E/I, for study team’s subsequent integration into one composite, prioritized E/I listing (Tasks #7 and #8). Assuming DCD approval, the set of SME-provided FXXI CSS E/I formed the DCD’s “candidate” set of 65 FXXI CSS E/I. Once this complete list of 65 candidate E/I was compiled, the CASCOM CEFA coordinator had intended to staff it to the CDR, CASCOM for his review and approval. This was planned in response to CDR, CASCOM’s request (which was independent of TRAC-LEE’s CEFA study) that his approved list of FXXI CSS E/I be placed on the CASCOM’s Internet Homepage. Such was fortuitous as the study team had all along planned as a direct part of CEFA to also have the CASCOM CEFA coordinator staff the DCD’s candidate E/I to the CDR, CASCOM. Once a CDR, CASCOM-approved set of FXXI CSS E/I was obtained, the study team planned to submit this complete set of E/I back to each DCD for his prioritization **“of all the E/I.”** Without knowledge of the composite SME-provided peacetime, wartime and overall risk ratings for all of the E/I, even to include those not from his proponent area, each DCD was to review each and every E/I for its perceived worth defined in terms of its indirect contribution to the FXXI battlefield effectiveness. The study team would then mathematically integrate individual DCD results, yielding an ordinal (i.e., first E/I; second E/I; third E/I, etc.), and cardinal (notionally: the first E/I scored a “.99”; the second E/I scored a “.98”; the third E/I scored a “.45”; etc.) prioritization of each E/I. Once completed, the prioritized list WITH the risk ratings included was planned to be briefed to the CDR, CASCOM along with an analysis of the driving risk factors and possible ways to mitigate risk. Due to higher priorities within the CASCOM, the DCD-approved lists of “candidate” proposals for FXXI CSS E/I were never submitted to the CDR, CASCOM for his review, approval and publication on the CASCOM’s Internet Homepage. Consequently, and for various reasons (reference Chapter 4, paragraph 4-1b(1)) the study team did not submit a complete list of all candidate FXXI CSS E/I to the DCD for their prioritization actions. Instead, the study team elected to ask internal TRAC-LEE analysts to play the role of CSS DCD and rank order the candidate set of E/I. This ranking was performed and the results included in this CEFA study report.

2-8. Integrate and analyze SME mini-assessments (Task # 9). Various analyses were conducted of the information contained in the resulting 65 mini-assessments. The following describes the major reviews performed. (Reference Chapter 3 for explanation of all analyses.)

a. Separate analyses summarizing the peacetime, wartime, and overall risk ratings and contributing risk factors for each of the three types of FXXI CSS designations (E, E-ORC, and I).

b. Analyses relating to the risk of fielding selected E/I in time for the First Digitized Division and Corps.

c. Analyses of changes in manpower requirements and efficiencies/effectiveness.

d. Analysis of E/I risk by CSS BOS function.

e. A "systems of systems" analysis in which the impact of prerequisites on E/I is reviewed.

2-9. Develop and staff coordinate a draft CEFA report to the participating CSS SME, and subsequently finalize the CEFA report for approval (Tasks # 10 and # 11). As a result of interviewing SME and collecting their written inputs to the CEFA questions, the study team reviewed, synthesized and in some cases modified (added to) various input information. It was always the study team's intent to staff coordinate this report in draft format, adjudicate SME review comments, and then publish a final report. However, given the identified study constraints and limitations (refer to Chapter 1), exacerbated by selected SME changes in duty locations and even retirements, and further impacted by the urgent need to assign the study team to other new TRADOC study requirements, the study agent decided that the draft CEFA study report would not be staff coordinated. Rather, it would be published it as "Technical Notes" for immediate use as a reference document. The findings and conclusions contained in this draft report are deemed robust enough to provide the CDR, CASCOM with insights relevant to the factors contributing most to E/I risk.

Chapter 3 FINDINGS

3-1. Purpose. This chapter summarizes the study results obtained from applying the CEFA methodology, to specifically include its related questionnaire.

3-2. Determination of the final set of 65 candidate FXXI CSS E/I.

a. Candidate FXXI CSS E/I. After having applied CDR, CASCOM's 7 Mar 97 definitions for FXXI CSS E/I to the strawman listing of about 160 initial E/I candidates, the SME arrived at a total of 65 candidate E/I as approved by their respective DCD. They are as listed alphabetically in Table 3.1 below.

Table 3.1. Alphabetical Listing of Candidate FXXI
CSS E/I (#1- #33)

1.	Advanced Radiographic System (ARS)
2.	Air Ambulance (UH-60Q MEDEVAC Helicopter)
3.	Ammunition Solar Cover (ASC)
4.	Armored Medical Evacuation Vehicle (AMEV)
5.	Armored Medical Transport Vehicle (AMTV)
6.	Ballistic Protection System (BPS)
7.	Cargo Bed Covers (CBC)
8.	Combat Service Support Control System (CSSCS)
9.	Contact Maintenance Truck (CMT)
10.	Container Handling Unit (CHU)
11.	Container Roll In/Roll Out Platform (CROP)
12.	Containerized Kitchen (CK)
13.	Defense Finance Battlefield System (DFBS)
14.	Digital Medical Record (DMR)
15.	Digital Source Collector (DSC)
16.	Driver Minder
17.	Drivers Vision Enhancer (DVE)
18.	Electro-Optic Test Facility (EOTF)
19.	Electronic Repair Shelter (ERS)
20.	Electronic Technical Manuals (ETM)
21.	Explosive Ordnance Response Vehicle (EODRV)
22.	Failure Analysis and Maintenance Planning System (FAMPS)
23.	Finance Smart Card Interface (Software Suite)
24.	Force Manning System (FMS) Module in CSSCS
25.	Force XXI Battle Command, Brigade and Below (FBCB2)- CSS Functionality
26.	Fork Lift Pallet Trailer (FLPT)
27.	Forward Repair System- Heavy (FRS-H)
28.	Heavy Equipment Recovery Combat Utility Lift and Evacuation System (HERCULES)
29.	Improved Environmental Control Units (IECU)
30.	Information Management Integration (IMI)
31.	Integrated Combat Service Support System (ICS3)
32.	Interactive Electronic Technical Manuals (IETM)
33.	Laundry Advanced System (LADS)

Table 3.1 (Continued). Alphabetical Listing of
Candidate FXXI CSS E/I (#34- #65)

34. Life-Time Oil Filter (LOF)
35. Lightweight Disposable Dearmer (LIDD)
36. Lightweight Maintenance Enclosure (LME)
37. Load Handling System- HEMTT (HEMTT-LHS)
38. Maintenance and Repair Support System (MARSS)
39. Medical Communications for Combat Casualty Care (MC4)
40. Medical Logistics- Division (MEDLOG-D)
41. Medical Situational Awareness and Control (MSAC)
42. Modular Ammunition Company (Mod Ammo Co)
43. Movement Tracking System (MTS)
44. Multicapable Maintainer
45. Multi-Technology Automated Card (MARC)
46. Munitions Survivability Software (MSS)
47. Palletized Loading System (PLS)- Division Support Command (DISCOM) XXI [PLS DISCOM XXI]
48. Petroleum Quality Assurance System (PQAS)49. Pocket Unit Maintenance Aid (PUMA)
50. Portable Unit Level Oil Analyzer (PUOLA)
51. Radio Frequency Tags (RF Tags)
52. Remote Controlled Reconnaissance Monitor (RECORM)
53. Remote Ordnance Neutralization System (RONS)
54. Reverse Osmosis Water Purification Unit (ROWPU)
55. Self-Contained Toxic Environmental Protective Outfit (STEPO)
56. Self- Loading/Offloading Trailer (SLOT)
57. Sensor Artificial Intelligence Communications Interactive Maintenance System (SACIMS)
58. Soldier's Portable On- System Repair Tool (SPORT)
59. Tactical Electric Power (TEP) and Associated Systems
60. Telemedicine (T-Med)
61. Test Equipment Modernization (TEMOD)
62. Transportation Coordinator's Automated Information for Movements System II (TC AIMS II)
63. Unit Ministry Team (UMT)
64. Vehicle integrated Multiple power Source (VIMEPS)
65. Warfighter Physiological Status Monitor (WPSM)

b. Prioritized FXXI CSS E/I. Tables 3.5- 3.7 (pages 3-32 through 3-34) list the 65 E/I in priority order of their perceived worth in terms of their indirect contribution to FXXI battlefield effectiveness. TRAC-LEE FXXI analysts determined this priority ordering. Furthermore, each of the 65 E/I has been displayed on a CEFA spreadsheet (large 4' x 3' matrix) in priority order along with its summarized questionnaire answers including individual peacetime, wartime, and overall risk ratings. (Copies of this matrix are available by contacting TRAC-LEE.)

c. The 65 E/I are distributed by the CSS BOS functions as follows.

ARM: 12; FUEL: 1; FIX: 20; MAN: 20; DIST: 9; ALL: 3
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d. AOE Carryovers, Army After Next (AAN), and Business Practices.

(1) As a result of the winnowing process of going from about 160 to 65 E/I, 53 strawman E/I were designated by their respective DCD as "AOE carryovers." These items consisted principally of materiel items, with some new organizational concepts. It was determined that these specific items were primarily developed under AOE, and that their fielding was imminent. Another 39 strawman E/I were confirmed to be AAN items. Appendix D lists the E/I that fell into these two categories.

(2) Also, BD, VM, Total Asset Visibility (TAV) and Intransit Visibility (ITV) were all declared by CASCOM as "business practices," and not to be examined by the CEFA questionnaire process. A CASCOM Jun 96 information paper entitled "CASCOM DIV XXI AWE Initiatives" (reference #7, Appendix A) reads "...BD is a combat distribution initiative to improve distribution operations in force projection theaters... Velocity Management- implements an echelon above division (EAD) and lower approach for increasing the responsiveness and efficiency of Army logistics systems utilized within the Division XXI." On the other hand, a draft TRAC DDA Sep 96 study plan (reference #4, appendix A) indicated that BD "is a holistic system...of information exchanges, management procedures, functional designs and reengineered operational process..." Further, this plan indicated that VM is "how the Army is going to do business...to get logistics support into the hands of the soldier as fast as any first-rate commercial firm, while providing a hedge against unforeseen interruptions in the logistics pipeline..." The reader is referred to the Multifunctional Section of CASCOM's Internet Homepage for access to information for BD-related briefings and an After Action Review (AAR) for an European BD demonstration.

e. Selected Anomalies in Development of the Final List of 65 Candidate FXXI CSS E/I. As a result of direct coordination between the CASCOM CEFA coordinator and each CEFA SME and his respective DCD, each SME presented to the study team his proponent candidates for designation as FXXI CSS E/I. However, the study team observed several instances where it felt that the CDR, CASCOM's 7 Mar 97 definitions for FXXI CSS E/I were not uniformly applied across the CSS community. When consulting with some SME about these cases, the study team was advised that their proponent DCD had in fact reviewed and approved their functional submissions, and that it was the "DCD's" decision as to what will be designated as a candidate for being labeled a FXXI CSS E/I. Further, during the conduct of this study, the CDR, CASCOM requested in May 97 that his staff publish on the CASCOM's Internet Homepage a complete listing of his approved set of FXXI CSS E/I. To accomplish this, the CEFA CASCOM coordinator intended to provide the CDR, CASCOM with the DCD's lists of candidate E/I as developed for this CEFA. The study team hoped that these aforementioned anomalies would have been resolved by the CDR, CASCOM's review prior to publication on the CASCOM Homepage. However, higher internal CASCOM priorities precluded submission of the DCD's candidate E/I to the former CDR, CASCOM prior to his Aug 97 retirement.

(Note: The study team recognizes that this CEFA could have focused only on a subset of the 65 E/I, which would have eliminated what the study team thought to be the selected anomalistic E/I. However, such would have been presumptuous on the part of the study team of the DCD [and specifically of at least one General Officer, who as the study team was advised personally reviewed and approved each of his proponent E/I]. As mentioned above, from May-Aug 97 the study team anticipated a CDR, CASCOM review which would likely have resolved these anomalies. When that review did not occur, and with time allotted to conduct this effort expiring, the study team elected to defer to the decisions of the proponent DCD, and incorporate for analysis all of the information provided to it from the CASCOM CEFA coordinator and SME. For additional discussion concerning this issue, refer to Chapter 4, paragraph 4-1b(1))

Consequently, each and every one of the 65 DCD-designated candidate FXXI CSS E/I was included in the analyses described below.

A few examples are provided below to illustrate the potential problem.

(1) Modular Ammunition Company. This was designated as a FXXI CSS Enabler. Yet other candidate E/I such as Modular CSS Organizations, Modular Multifunctional Organizations, Modular Quartermaster Organizations, and the Modular Transportation Organizations (Cargo Transfer Company) were all determined by varied CASCOM personnel to be AOE carryovers (Appendix D).

(2) Test Equipment Modernization (TEMOD) Program. This was designated as a FXXI CSS Enabler. Yet the SME-provided description of TEMOD, (refer to the TEMOD mini-assessment in Volume II), reads in part "...A requirement exists to continually replace the Army's aging test equipment while at the same time preventing the proliferation of non standard special purpose Test, Measurement and Diagnostic Equipment (TMDE)." Given this description, the TEMOD Program perhaps could have been designated as an AOE carryover, similar to other candidate E/I planned to be upgrades/improvements to existing materiel items. Examples of these are the Family of Medium Tactical Vehicles (FMTV), the Modular General Purpose Tent, and Tactical Wheeled Vehicle Enhancements. These were eventually designated as AOE carryovers.

(3) Force Manning System (FMS), Medical Situational Awareness and Control (MSAC), and the CSSCS. The AG School DCD designated the FMS as a separate FXXI CSS "Initiative." SME-provided description of the FMS (refer to the FMS mini-assessment in Volume II) reads in part "...Designed as a prototype of the desired personnel functionality within the CSS Control System (CSSCS)." Also, the AMEDDC&S DCD designated the MSAC as a separate FXXI CSS "Initiative." SME-provided description of the MSAC reads in part "... In FY 98 MSAC is planned to become the medical module for the CSSCS, and is under the MC4 umbrella FXXI Initiative." However, the TSM for CSSCS also separately designated CSSCS as another FXXI CSS "Initiative."

(4) Improved Environmental Control Units (IECU). This was designated as a FXXI CSS "Initiative" AND in part as an AOE Initiative, AND in part as an AAN Initiative. SME-provided description of the IECU (refer to IECU mini-assessment in Volume II) reads in part "...FXXI CSS E/I? Yes, a FXXI Initiative...When completely fielded, will result in force structure equipment efficiencies... AOE CSS E/I? Yes, in part. Selected internal components have been previously replaced with upgraded components to be compatible with the new refrigerants...AAN CSS E/I? Yes, in part. By that time, a completely non-ozone depleting refrigerant will hopefully be available for use..."

(5) Digital Medical Record (DMR) and the Multi-Technology Automated Card (MARC). AMEDDC&S DCD designated the DMR as a FXXI CSS "Initiative." It relies heavily on the MARC technology. However, the AG School DCD designated the MARC as a separate FXXI CSS "Initiative." Refer to the appropriate mini-assessment in Volume II: (a) MARC- it is an identification card size reader device serving as an electronic identification key and limited data carrier for the individual soldier, and (b) the DMR will use the MARC technology to capture patient demographics, diagnosis and treatment as far forward and as close to the point of injury as possible.

(6) Base Shop Test Facility (BSTF) as part of the Integrated Family of Test Equipment (IFTE) and the Contact Maintenance Truck (CMT). The BSTF was not designated by the proponent DCD as a candidate for a FXXI CSS "E/I" because its FUE date was before the FY 98 date as established in the 7 Mar 97 CDR, CASCOM definitions. (Even though on 3 Apr 97 when the CDR, CASCOM briefed²¹ the CDR, TRADOC on the Right-size DISCOM, selected briefing charts discussed the BSTF under the category of "Initiatives" and "Potential DISCOM Size reducers.") However, the CASCOM DCD proponent for the CMT designated it for CEFA purposes as a FXXI CSS "Enabler- ORC," even though the Sep 96 CASCOM CSSMMP indicated that the CMT's FUE was scheduled for the 3rd quarter, FY 96. Although not perfectly sure, the study team thinks that the CMT's FUE has already occurred.

(7) Unit Ministry Team (UMT) and the Telemedicine (T-Med) issues. Proponent DCD designated each of these as FXXI CSS "Initiatives." However, they then indicated (refer to their mini-assessments in Volume II) that the Phase II portion of the UMT Initiative would definitely require an "INCREASE" in manpower requirements, and the T-Med initiative may require a similar "INCREASE." The 7 Mar 97 CDR, CASCOM definition for a FXXI CSS initiative reads "...Initiative- a DTLOMS change for which there is currently no associated force structure reduction..." This definition as written therefore does not preclude "increases" to manpower requirements. However, given the downsizing in CSS manpower associated with ongoing CASCOM Right-size DISCOM redesigns, it could seem counter productive to propose "Initiatives" which are suspected of increasing manpower requirements. Respective SME did not indicate if their proposed

²¹ CDR, CASCOM Right-size DISCOM Briefing to CDR, TRADOC, 3 Apr 97.

"INCREASES" in manpower requirements would somehow synergistically result in some future overall net decrease in CSS manpower requirements.

(8) T-Med Initiative and Medical Communications for Combat Casualty Care (MC4). The AMEDDC&S DCD designated MC4 and T-Med as separate FXXI CSS Initiatives. Yet the T-Med SME responded in his assessment (refer to Volume II) that T-Med is part of the MC4 umbrella FXXI medical initiative.

(9) The new FXXI CSS Redesign. On 23 Apr 97 the former CDR, CASCOM briefed the Command & General Staff College on emerging results of the TF XXI AWE. Briefing slides read "...CSS Initiatives assessed during the TF XXI AWE... CSS Reorganization- Successfully provided effective support to the brigade maneuver force...CSS reorganization shows great potential." Yet, the study team was advised by CASCOM personnel that the CSS Redesign was not to be designated as a FXXI CSS E/I. Consequently, no associated CEFA risk assessment information was provided.

(10) Comanche/two-level maintenance. On 3 Apr 97 the CDR, CASCOM briefed CDR, TRADOC concerning the possible reduction in maintenance manpower requirements attributed to the Comanche. Briefing charts indicated that the Comanche was an "Enabler" and read "... Description/Characteristics...48-66 percent potential reduction in maintenance manpower with 15percent increase in availability as compared to AH-64D, 2-37 percent potential reduction in maintenance manpower with 11 percent increase in availability as compared to OH-58D...Potential Space Savings (sic): space savings are expected." However, the study team was advised²² after this briefing in Jul 97 "...that the DCD, US Army Aviation Center & School reviewed the Comanche two-level maintenance as a logistics enabler/initiative submission (to this CEFA study) and has decided to withdraw it from the CEFA. The Comanche offers many enabling improvements, but including integrated design functionality as a separate logistics initiative only complicates the process and dilutes the value of critical CSS enablers and initiatives." Yet, even after receipt of this email, the study team continued to observe the reporting of "Comanche/two-level maintenance" as a FXXI CSS "enabler" for reducing maintenance manpower requirements.

3-3. Analysis of CEFA Risk for the 65 Candidate FXXI CSS E/I. Using SME-provided responses resulting from the questionnaire process, the study team developed the set of 65 mini-CEFA assessments provided in alphabetical order in Volume II. The reader is urged to review each of these mini-assessments to acquire an understanding of the E/I under review, as well as the rationale for assignment of individual risk ratings. The following sets of analyses were derived from information contained in these mini-assessments.

a. Analysis of FXXI CSS Enabler (E) Risk. Table 3.2 below presents for each identified FXXI CSS "Enabler" their CSS BOS function, the TRAC-LEE assigned

²² 31 Jul 97 email from US Army Aviation Center & School (Office of the DCD), subject: Enablers.

ordinal priority (“perceived worth” thought of in terms of indirect contribution to battlefield effectiveness), peacetime/wartime/overall risk ratings, and major contributing risk factors. Separate analyses relating to priority ordering, prerequisite impacts and other parameters will be reviewed in different sections within this Chapter. Figure 3.1 depicts the Red, Amber, Green percentage breakouts for “Overall” risk for these 11 FXXI CSS Enablers.

Table 3.2. FXXI CSS Enablers

	TITLE	BOS	ORDINAL PRIORITY				RISK			RISK FACTORS							
			0 to .25	.26 to .50	.51 to .75	.76 to 1.00	Peacetime	Wartime	Overall	\$	Pre-Req ²³	Tech Caps	Testing	Con/MNS/ORD	Equip/MP Req'mts	Wartime BU	Other
1.	DSC	FIX		.28			A	G	A	X							
2.	EOTF	FIX				.85	A	A	A	X			X			X	
3.	ICS3	ALL		.30			G	G	G		G						
4.	LADS	MAN	.17				G	G	G								
5.	MEDLOG-D	MAN		.49			A	A	A	X	U		X		X	X	
6.	Mod AMMO CO	ARM	.22				A	G	A	X			X	X	X		
7.	Multicap. Maintainer.	FIX			.67		A	G	A		U		X				X
8.	ROWPU	MAN			.57		G	G	G								
9.	SPORT	FIX		.43			G	A	A							X	
10	TEP	FIX		.40			G	A	A								X
11	TEMOD	FIX		.45			A	G	A	X							X

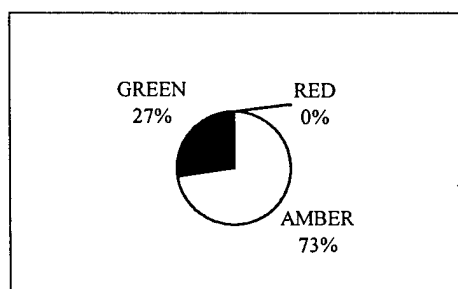


Figure 3.1. FXXI CSS Enabler “Overall” Risk

²³ Prerequisite risk status is shown as R/A/G. If unknown, it is shown as “U.”

ICS3, LADS, and the ROWPU enablers were rated “Green,” with the remaining 11 having “Amber” risk. No single enabler was estimated at “Red” risk. Table 3.2 lists the major factors, which contributed to risk, and indicates that inadequate procurement funding and lack of testing contribute the most to risk. Note: SME reported that SPORT, TEP and TEMOD would probably not reduce manpower requirements, but rather would reduce equipment requirements.

b. Analysis of FXXI CSS Enabler-Offset Required Capability (E-ORC) Risk.

Table 3.3. FXXI CSS Enablers-Offset Required Capabilities

	TITLE	BOS	PRIORITY				RISK			RISK FACTORS							
			0 to .25	.26 to .50	.51 to .75	.76 to 1.00	Peacetime	Wartime	Overall	\$	Pre-Req ²⁴	Tech Caps	Testing	Con/MNS/ ORD	Equip/MP Req'mnts	Wartime Bu	Other
1.	ASC	ARM	.25				A	G	A	X							
2.	CMT	FIX		.46			G	G	G								
3.	DFBS	MAN		.46			A	G	A	X	A						
4.	ERS	FIX			.65		G	A	A							X	
5.	EODRV	ARM		.42			R	G	R	X	R						
6.	FRS-H	ARM			.56		R	G	R	X					X		
7.	HERC.	FIX			.54		G	G	G								

Table 3.3 above presents similar information for each identified FXXI CSS E- ORC. Figure 3.2 below depicts the Red, Amber, and Green percentage breakouts for “Overall” risk for the 7 E-ORC. CMT and the Hercules maintenance vehicles were rated “Green,”

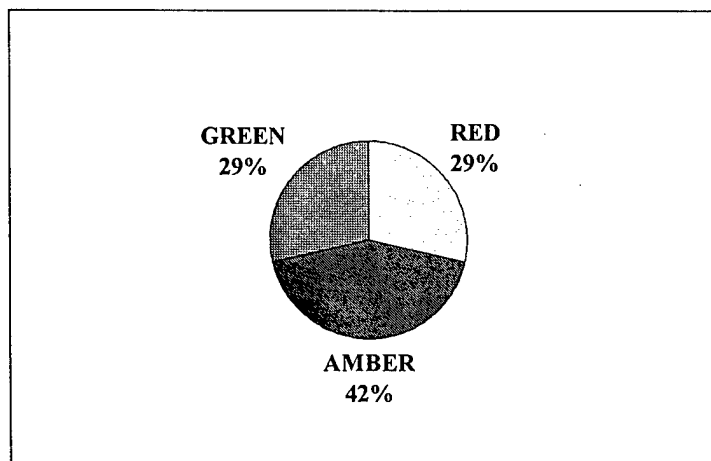


Figure 3.2. FXXI CSS E-ORC “Overall” Risk

²⁴ Prerequisite risk status is shown as R/A/G. If unknown, it is shown as “U.”

with the EODRV and the FRS-H estimated to have “Red” risk. The ASC, DFBS and the ERS were estimated at “Amber” risk. Note in Table 3.3 that the EODRV also has a prerequisite which itself is rated “Red.” As discussed in the EODRV mini-assessment in Volume II, if this prerequisite were mitigated to an “Amber” risk, the EODRV would then have defaulted to an “Amber” risk status due to insufficient funding.

c. Analysis of FXXI CSS Initiative (I) Risk. Table 3.4 below present similar information for each identified FXXI CSS “Initiative.”

TABLE 3.4. FXXI CSS Initiatives

	TITLE	BOS	PRIORITY				RISK			RISK FACTORS							
			0 to .25	.26 to .50	.51 to .75	.76 to 1.00	Peacetime	Wartime	Overall	\$	Pre-Req ²⁵	Tech Caps	Testing	Con/MNS/ ORD	Equip/MP Req mts	Wartime BU	Other
1.	ARS	ARM	.14				G	G	G								
2.	AIR- AMB	MAN			.52		R	G	R	X	A	X		X			
3.	AMEV	MAN		.41			R	A	R	X	A		X				
4.	AMTV	MAN		.41			R	A	R	X	A						
5.	BPS	ARM	.22				A	G	A	X							
6.	CBC	FIX	.12				A	G	A	X							
7.	CSSCS	ALL				.99	G	G	G		G						
8.	CHU	DIST		.49			A	G	A	X			X				
9.	CROP	DIST			.54		A	G	A	X			X				
10.	CK	MAN		.26			G	G	G								
11.	DMR	MAN		.39			A	G	A	X	A						
12.	DRI-MDR	MAN	.23				A	G	A	X				X			
13.	DVE	DIST				.77	A	G	A	X							
14.	ETM	FIX		.33			A	G	A	X							
15.	FAMPS	FIX		.37			R	A	R	X	A		X	X			
16.	Fin. Software	MAN		.41			A	G	A		A		X	X			
17.	FMS	MAN			.58		G	A	A		G					X	
18.	FBCB2-CSS	ALL				1.0	A	A	A		U/G		X			X	X
19.	FLPT	ARM			.52		R	G	R	X			X	X			
20.	IECU	MAN	.16				A	A	A	X						X	
21.	IMI	MAN		.48			R	A	R	X	A	X		X	X		
22.	IETM	FIX		.31			R	A	R	X	A		X	X		X	
23.	LOF	FIX	.17				R	G	R	X			X	X			
24.	LIDD	ARM		.38			A	G	A				X				
25.	LME	FIX		.29			A	G	A	X							
26.	LHS	DIST			.63		A	G	A	X							

²⁵ Prerequisite risk status is shown as R/A/G. If unknown, it is shown as “U.”

TABLE 3.4. FXXI CSS Initiatives (Continued)

	TITLE	BOS	PRIORITY				RISK			RISK FACTORS							
			0 to .25	.26 to .50	.51 to .75	.76 to 1.00	Peacetime	Wartime	Overall	\$	Pre-Req ²⁶	Tech Caps	Testing	Con/MNS/ ORD	Equip/MP Req'mnts	Wartime BU	Other
27	MARSS	FIX		.31			A	G	A	X	U		X	X			
28	MC4	MAN			.62		R	A	R	X	R		X		X	X	
29	MSAC	MAN		.47			R	A	R	X	A	X	X	X			
30	MTS	DIST			.60		A	G	A	X	U						
31	MARC	MAN		.29			A	G	A	X							
32	MSS	ARM	.20				A	G	A	X				X			X
33	PLS-DISCOM	DIST			.55		A	G	A	X							
34	PQAS	FUEL	.20				A	A	A	X		X	X			X	
35	PUMA	FIX		.31			R	G	R	X	A				X		
36	PUOLA	FIX	.21				R	G	R	X			X	X			
37	RF-TAG	DIST			.67		G	G	G								
38	RECORM	ARM		.33			A	G	A								X
39	RONs	ARM		.28			A	A	A	X					X		X
40	STEPO	ARM		.40			A	A	A	X						X	X
41	SLOT	DIST		.28			A	G	A	X				X			
42	SACIMS	FIX		.40			A	A	A	X	A			X		X	
43	T-MED	MAN		.27			A	A	A	X	U			X	X	X	
44	TC-AIMS II	DIST		.45			A	G	A	X	U				X		
45	UNIT MINIST	MAN	.21				R	A	R	X	A					X	
46	VIMEPS	FIX	.22				A	G	A	X			X	X			
47	WPSM	MAN	.14				R	A	R	X	U	X			X		

²⁶ Prerequisite risk status is shown as R/A/G. If unknown, it is shown as "U."

Figure 3.3 depicts the Red, Amber, Green percentage breakouts for “Overall” risk for the 47 Initiatives. ARS, CSSCS, CK, and RF-TAG were rated “Green.” AIR-AMB, AMEV,

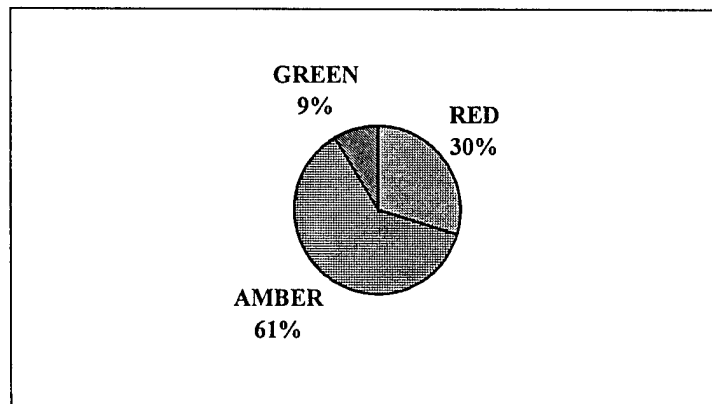


Figure 3.3. FXXI CSS Initiative
“Overall” Risk

AMTV, FAMPS, FLPT, IMI, IETM, LOF, MC4, MSAC, PUMA, PUOLA, UMT, and WPSM were each rated “Red.” The remaining 29 Initiatives were rated “Amber.” The driving risk factors were insufficient funding, and lack of testing and requirements documents. Note from Table 3.4 that the MC4 also has contributing prerequisite risk. As discussed in the MC4 mini-assessment in Volume II, MC4 has several prerequisites, two of which are themselves rated “Red.” If these prerequisite risks were each mitigated to “Amber,” the SME personally felt that MC4 would still be assessed as “Red” due to insufficient funding and lack of testing.

d. Analysis of “Overall” Risk Ratings of FXXI CSS Enablers (E and E-ORC combined) Compared to FXXI CSS Initiatives. Figure 3.4 graphically illustrates the results obtained when all E and E-ORC are combined into one set and then compared to the set of Initiatives. By combining the E and E-ORC results together, one can see that they are estimated to be at less risk than the combined set of Initiatives. As a set, the “E and E-ORC” group has about 20 percent fewer “Red” and about 20 percent more “Green” ratings than does the “I” group. However, each of these two groups has about the same percentage (60 percent) of “Amber” risk. This finding is consistent with the definitions of E, E-ORC and I. Implicit in the definitions for an E and E-ORC is “strong likelihood/certitude” that force structure reductions and/or the offsetting of required capabilities will occur. It is likely that this certitude cannot be realized for items that are conceptual and untested (usually the more risky). Although the set of 27 Initiatives contains some that are rated “Green”, it likewise contains many others which are very young in their development cycles and require funding and testing. As shown, this set of 27 Initiatives also has the higher percentage of “Red” ratings.

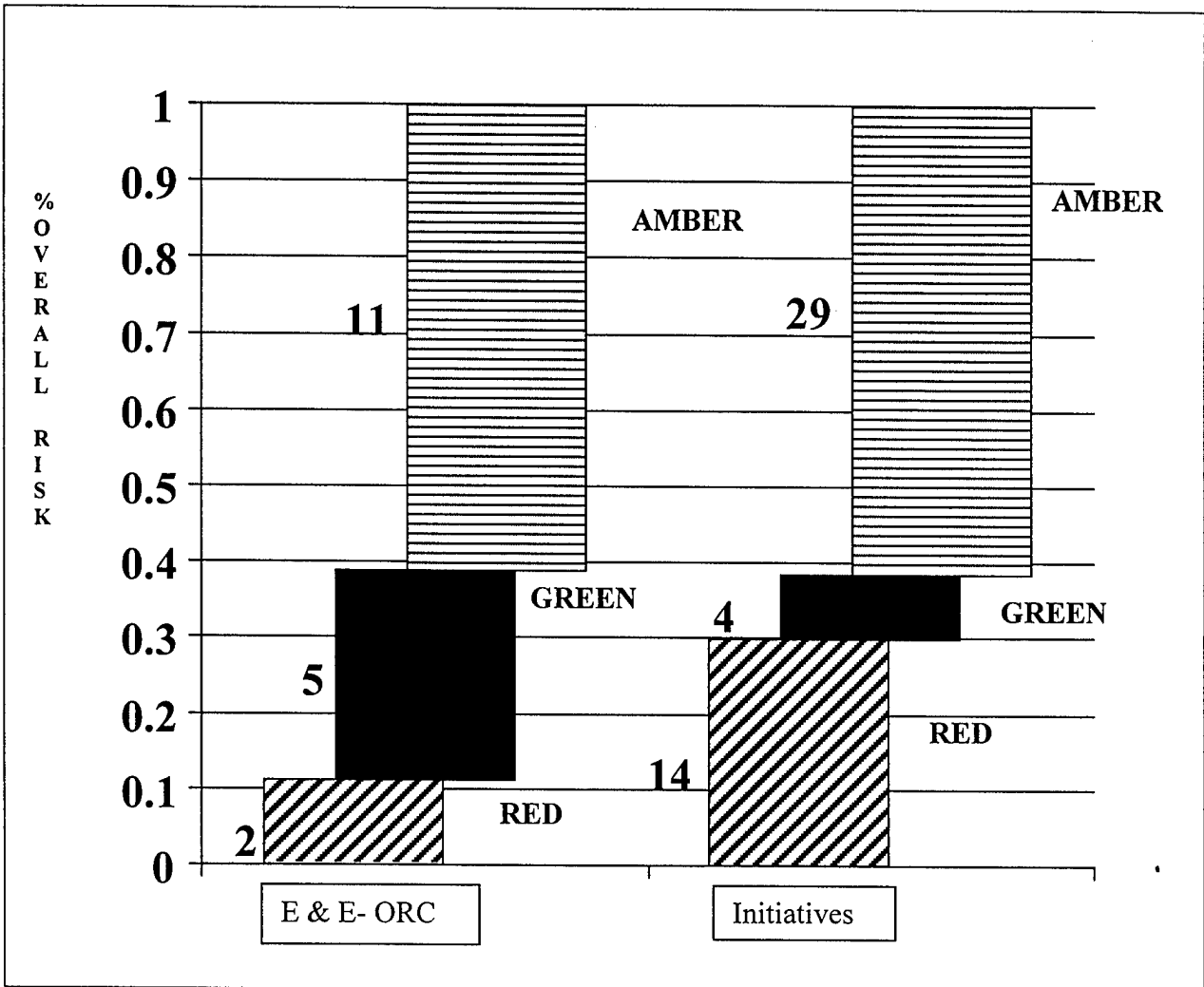


Figure 3.4. FXXI CSS “Overall” Risk Comparison of (E & E-ORC Combined) to I

e. Analysis of Risk Factors. Figure 3.5 below provides a frequency count of those major risk factors which most contribute to overall risk for the set of 65 E/I.

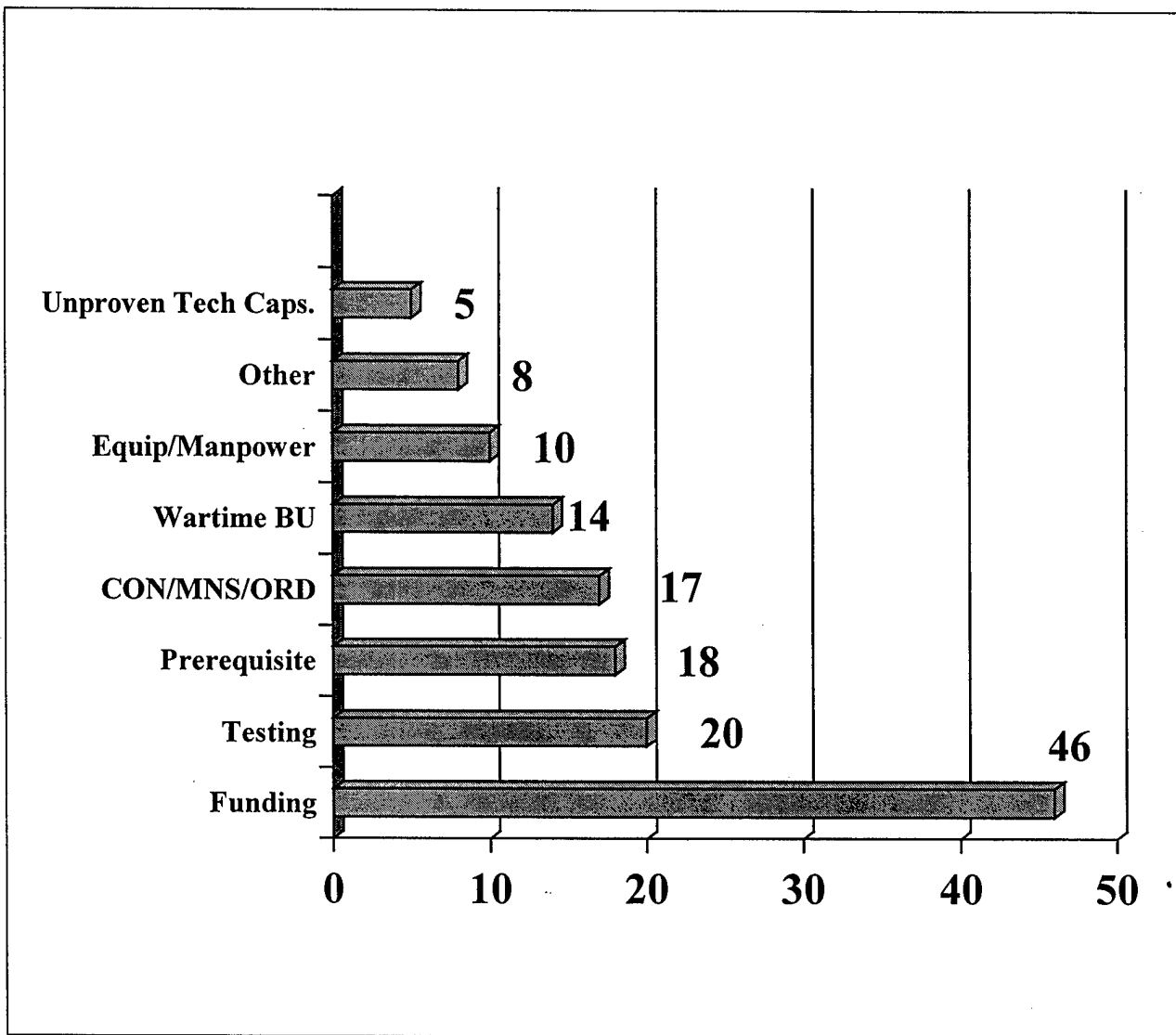


Figure 3.5. Analysis of Risk Factors for the Set of 65 E/I.

(1) The above findings support what the

1996 Army Modernization Plan²⁷ indicated in Mar 96 that “We are Amber*, headed to Red”* (as based on lack of funding).

(*Refer to Appendix C, CEFA Questionnaire, for definitions of these risk ratings.)

The study team notes that some of the identified risk factors are interrelated and often a function of where the given E/I is in its development cycle. For example, lack of overall funding can certainly impact lack of testing, as funds are needed not to only procure but

²⁷ HQDA ODCSOPS 1996 Army Modernization Plan, page vii, 8 Mar 96.

also to test an item. Also, lack of testing can contribute to having unproven technical capabilities (especially for those items, which are not Commercial-Off-the-Shelf [COTS]).

(2) Lack of sufficient funding, lack of testing, unproven technical capabilities, lack of approved Concept/MNS/ORD, and uncertainties surrounding acquiring requisite increases in equipment and manpower requirements contribute most to programmatic risk. Whereas, lack of planned wartime backup systems contributes the most to wartime risk. Impacts caused by prerequisites and "other" factors contribute in some degree to both areas. Other factors can include, for example, such things as (a) peacetime impacts associated with developing an item that might severely affect the training of the US Army Reserve (USAR) and the Army National Guard (refer to Multicapable Maintainer mini-assessment in Volume II); (b) declining numbers of TRADOC staff officers to develop concepts/MNS/ORD (refer to the TEMOD mini-assessment); and (c) delays in procurement schedules that result in the fielding of integral computer equipment (e.g., 386 processors; refer to the RECORM mini-assessment in Volume II) which is obsolete technology at the time of FUE.

f. Analysis of FXXI CSS E, E-ORC and I Risk Combined. Figure 3.6 provides the results obtained when all 65 candidate FXXI CSS E/I were combined into one group.

(1) Overall "Red" risk ratings. The percentage estimated to be at severe risk ("Red") and therefore having an Overall "Red" risk rating is about 25 percent. Each of these 16 E/I is rated overall "Red" due to its "Red" Peacetime risk. Their wartime risks were estimated at either "Amber" or "Green."

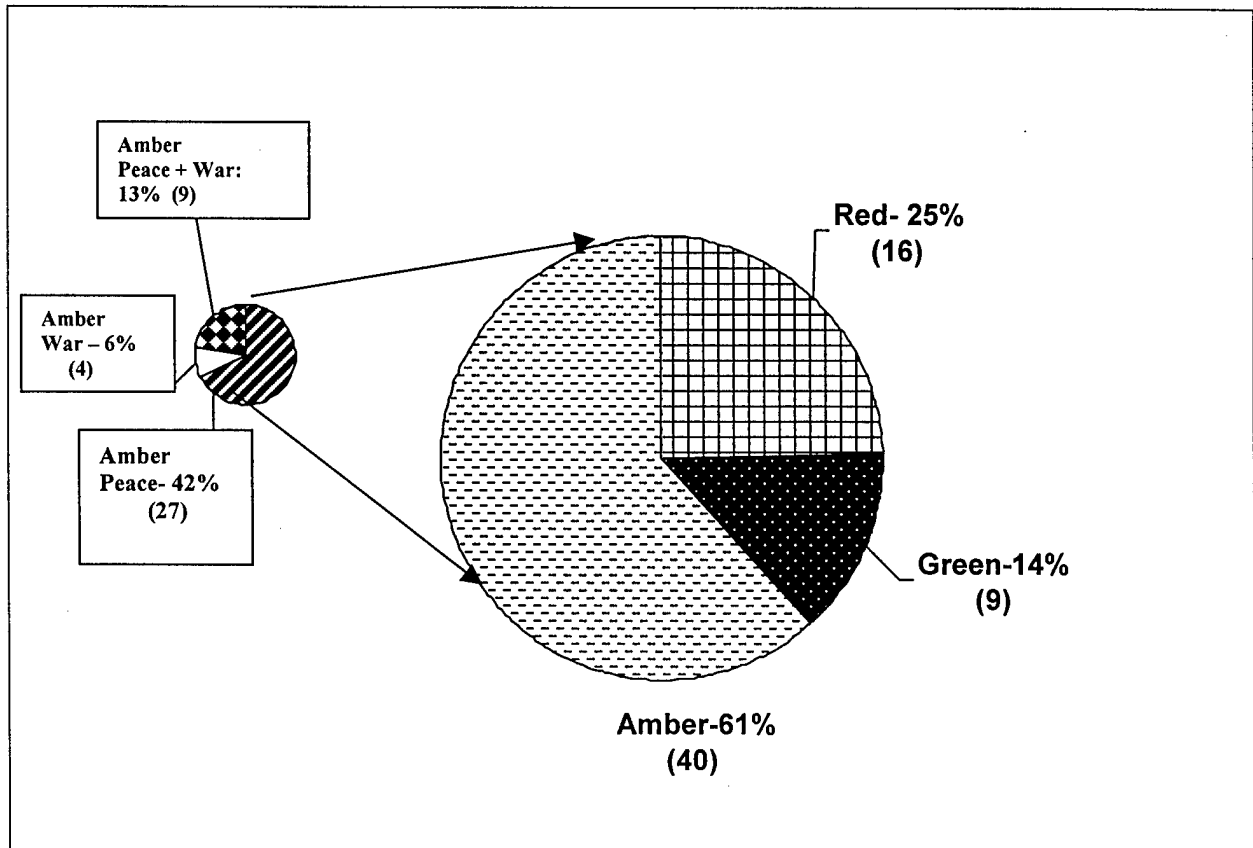


Figure 3.6. FXXI CSS E/I (all 65 together) "Overall" Risk

The 16 FXXI CSS E/I that comprise this "Red" risk set are:

MAN: Air Ambulance, AMEV, AMTV, IMI, MC4, MSAC, WPSM, and Unit Ministry Team.

FIX: FAMPS, FRS-H, IETM, LOF, PUMA, and PUOLA.

ARM: EODRV and FLPT

The primary contributing peacetime risk factors were lack of funds and requirements documents, unproven technical capabilities, lack of testing; and in selected cases possible increases in requirements for extra equipment and manpower.

Note: as discussed later in this chapter (paragraph 3-3g(5), NONE of these 16 E/I are estimated to be fielded in time for FXXI.

(2) Overall "Green" risk ratings. The percentage estimated to be overall "Green" is 14 percent. All nine of these FXXI CSS E/I therefore have both Peacetime and Wartime "Green" risk ratings. These nine are as follows.

MAN: CK, LADS, and ROWPU

FIX: CMT and HERC

DIS: RF TAGS

ARM: ARS

ALL: CSSCS and ICS3

(3) "Amber" overall risk ratings. The remaining 40 FXXI CSS E/I estimated as having "Amber" overall risk vary as to their primary contributing risk factors.

(a) Nine E/I had "Amber" risks attributable to both peacetime AND wartime factors. These nine are:

FIX: EOTF, IECU, SACIMS

MAN: MEDLOG-D and TELE-MED

FUEL: PQAS

ARM: RONS and STEPO

ALL: FBCB2

The primary contributing risk factors were (a) peacetime: lack of funds and requirements documents, unproven technical capabilities, lack of testing, peacetime prerequisite risks and (b) wartime: lack of adequate backup systems, inherent wartime employment risks, and wartime prerequisite risks.

(b) Four E/I had "Amber" risks attributable to only wartime factors (i.e., their peacetime risks were estimated as "Green.") These four are:

FIX: ERS and SPORT

MAN: FMS

ALL: TEP

The primary contributing risk factors were: lack of adequate wartime backup systems, inherent wartime employment risks, and wartime prerequisite risks.

(c) 27 E/I had "Amber" risks attributable to only peacetime factors (i.e., their wartime risks were estimated to be "Green"). These 27 are:

**FIX: CBC, DSC, DRI-MDR, ETM, LME, MARSS, Multicapable Maint.,
TEMOD, VIMEPS**

ARM: ASC, BPS, LIDD, Mod Ammo Co, MSS, RECORM

DIST: CHU, CROP, DVE, LHS, MTS, PLS-21, SLOT, TC-AIMS II

MAN: DFBS, DMR, FIN-Software, MARC

The primary contributing peacetime risk factors were: lack of funds and requirements documents, unproven technical capabilities, lack of testing, and peacetime prerequisite risks.

g. Analysis of FXXI CSS E/I Fielding Schedules. In the CEFA questionnaire (Appendix C) SME were asked three questions concerning when they expected that their E/I would be fielded (FUE). These questions were: (a) Question #30a. In time for the First Digitized Division (FY 00)? (b) Question #30b. In time for the First Digitized Corps (FY 06)? And (c) Question #30c. During FY 07-10? Figure 3.7 graphically depicts the numbers of E, E-ORC and I estimated to be fielded by each of these three time periods. It should be noted that if an "Unknown" response to these questions was either provided by the SME, or assigned by the study team as based, say, on a reported lack of funding, then for this sub-analysis such an "Unknown" response was assumed to be a "No" response. For example, as reported in Volume II the information provided in Jun 97 by the proponent for the DVE indicated that "DVE is currently unfunded. Estimated unit cost is \$15,000. \$37M in funding from FY 98- FY 05 (is) required to fund initial units..." Consequently and in the absence of any other information, the study team assigned an "Unknown" ("No") for the availability of DVE in time for the First Digitized Division/Corps. (Note: when this CEFA began in Jan 97, HQDA plans called for fielding the First Digitized Corps by FY 06. In Aug 97 HQDA ODCSOPS redesignated FY 04 as the planned fielding date. No attempt was made to acquire updates from SME for this change in FY. CEFA answers are based on the FY 06.)

(1) As shown in Figure 3.7, it is expected that

About 28 percent of the E, E-ORC and I will be fielded IN TIME FOR THE FIRST DIGITIZED DIVISION.

This fielding percentage is expected to increase only to about 37 percent IN TIME FOR THE FIRST DIGITIZED CORPS.

By the end of the FXXI time period (i.e., by FY 10), this percentage is estimated to only be about 38 percent.

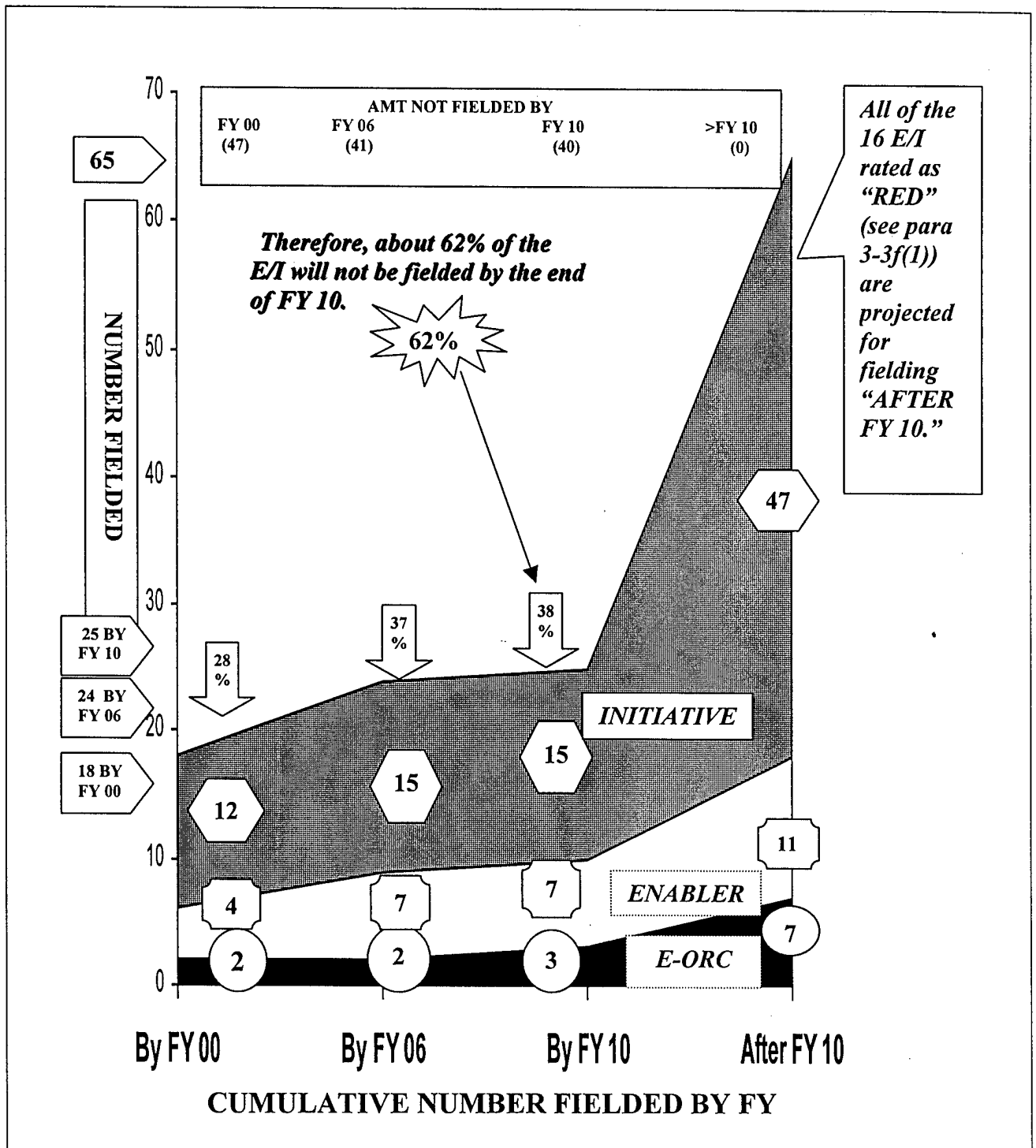


Figure 3.7. Cumulative Number of FXXI CSS E/I Fieldied over Time

(2) First Digitized Division (By FY 00) set of FXXI CSS E/I. This set includes the following E/I.

E-ORC: Fix- CMT and ERS. (2)

E: All- ICS3.

Fix- SPORT.

Man- LADS and TEP. (4)

I: All- CSSCS and FBCB2 (CSS).

Arm- ARS and RONS.

Dist- CHU, MTS, RF TAGS and TC AIMS II.

Fix- ETM and IECU.

Man- CK and FMS. (12)

With reference to the 3 Apr 97 CDR, CASCOM briefing to the CDR, TRADOC (refer to Chapter 1), briefing charts indicated the following. (Note: the study team assumes since this statement begins with "Enablers" and in its paragraph (3)

discusses the offsetting of requirements or reductions in strengths over time (both unique only to the definition of "Enabler"), that the word "initiatives" in paragraph (1) and reference to "only an insignificant few" in paragraph (2) all really refer to FXXI CSS "Enablers.")

"...BOTTOM LINE (continued)...Enablers- (1) there are significant initiatives being developed in the areas of technology, doctrine and training. (2) Only an insignificant few will reach maturity by the establishment of the first high tech division. (3) Because of the above, there can be no major offset of requirements or reductions in strength in the near term. (4) Reduction in DISCOM strength can be accomplished over time as technology, new skill and training are developed, resources produced and assimilated into the force. And (5) until then, significant downsizing will result in unacceptable level of risk to the FXXI Division's ability to accomplish its wartime mission."

With respect to the second (2) bottom line statement as quoted above, it should be noted that this analysis estimates that about 1/3 (2 E- ORC and 4 E [6] divided by a total of 7 E- ORC and 11 E [18]) of all possible E and E- ORC will be fielded in time for the First Digitized Division. This is not "an insignificant few."

(3) First Digitized Corps (By FY 06) set of FXXI CSS E/I. This set includes those for the First Digitized Division AND 6 new E/I. They are as follows.

**E: Fix- EOTF and MULTICAPABLE MAINTAINER.
Man- ROWPU. (3)**

**I: Arm- LIDD and RECORM.
Fuel- PQAS. (3)**

(4) FXXI (By FY 10) set of E/I. This set includes those for the First Digitized Division and Corps AND one new E-ORC, namely the HERCULES.

E-ORC: Fix- HERCULES (1)

(5) After FY 10. This set includes 40 more E-ORC, E and I. They are as follows.

E-ORC: Arm- ASC and *EODRV.
Fix- *FRS-H**.
Man- DFBS. (4)**

**E: Arm- MOD AMMO CO.
Fix- DSC and TEMOD.
Man- MEDLOG D. (4)**

I: Arm- BPS, *FLPT, MSS and STEPO.
Dist- CROP, DVE, LHS, PLS-21, and SLOT.
Fix- CBC, DRIVER MDR, *FAMPS**, *IETM**, *LOF**, LME, MARSS,
*PUMA**, *PUOLA**, SACIMS and VIMEPS.
Man- *AIR AMB**, *AMEV**, *AMTV**, DMR, FIN SOFTWARE, *IMI**,
*MC4**, *MSAC**, MARC, T- MED, *UMT** and *WPSM**. (32)**

***Note: The italicized 16 E/I are those in the set of 65 FXXI CSS E/I with
"RED" Overall Risk ratings. "ALL" of these 16 are projected to be fielded
sometime after FY 10.**

(6) It is important to reiterate that from the above:

By the end of FXXI (by FY 10) it is estimated that only about 38 percent (25/65) of the combined FXXI CSS E/I will be fielded (FUE).

h. Analysis of FXXI CSS "Risk Over Time" (From First Digitized Division (FY 00 until After FY 10).

(1) If the Army were not limited by resources, primarily funds, it would field all FXXI CSS E/I as quickly as they could be developed, tested and assimilated into units. A schedule such as the simultaneous fielding of all the available E/I would then immediately maximize their CSS contributions to battlefield effectiveness. On the other hand, if the Army were constrained ONLY by funds and all the E/I were fully ready for fielding, then they would likely be fielded in some priority sequence related to their individual/synergistic contribution to battlefield effectiveness.

Thus, assuming that the priority sequencing (ordinal ranking) for each E/I as established by TRAC-LEE FXXI analysts was a reasonable depiction of its perceived worth, as thought of in terms of indirect contribution to battlefield effectiveness, one could simply field each E/I accordingly.

However, limited resources, coupled with the varied stages of each FXXI CSS E/I's own Combat Development/Materiel Development life cycles, can sometimes inhibit fielding new systems in a way that always maximizes their contributions to battlefield effectiveness. Further, certain brand new CSS systems, some still in their conceptual stages, may be thought of as synergistically contributing more to combat effectiveness than say some older systems. These new E/I may often have to wait their fielding turn behind perhaps some other CSS systems having more mature combat/materiel development life cycles (e.g., just about ready to be fielded). The following describes the TRAC-LEE-derived ordinal ranking of each of the 65 E/I and its application to estimating each E/I's perceived worth thought of in terms of its indirect contribution to battlefield effectiveness. What follows is "one way" of examining the effectiveness of the SME-estimated fielding schedules for the set of FXXI CSS E/I.

(2) TRAC-LEE-derived ordinal ranking of each of the 65 E/I. One overall "ordinal" ranking (i.e., 1st, 2nd, 3rd, etc.) was obtained from combining TRAC-LEE analysts' individual opinions relating to each FXXI CSS E/I "relative worth (refer to Appendix C, paragraph 41).

(a) As discussed in paragraph 3-2 of this chapter, the study team thought that a few E/I belonging to different CSS proponents perhaps could have been combined into one E/I. However, the study team had to assume otherwise and defer to DCD-designated SME who were adamant that their given E/I were individualistic enough to warrant separate FXXI recognition. This may have been driven by the potential requirement for DCD to fund their respective E/I.

Consequently, each of the 65 E/I was considered independently of any other E/I as it relates to its unique Functional Operational Capability²⁸ and its functional contribution to the battlefield. There was no attempt to define and/or quantify the synergistic interactions and contributions, if any, of the impacts of one E/I on another E/I. Such would have been beyond the scope of this analysis and clearly beyond the subjectivity of the responses provided by CSS SME.

(b) The backdrop around the TRAC-LEE ranking process assumed that each FXXI CSS E/I was fielded with all its prerequisites; that each E/I had its own perceived worth, in terms of its indirect contributions to battlefield effectiveness; and that the maximum relative worth for any given E/I was an amount equal to one (1). Thus, it was possible to have obtained a maximum of 65 units of perceived worth if all 65 E/I were thought of as contributing equally to battlefield effectiveness. Then, as a result of a mathematical normalization process used to combine analysts' ordinal scores, a "cardinal" ranking of all the E/I was computed (e.g., the E/I ranked as # 1 had an ordinal score of "1.0000," the E/I ranked as # 2 had an ordinal score of, say, ".9786," the third ranked item had a score of say ".6878," etc. This computed cardinal ranking score was then used as a way of thinking of an E/I's "perceived worth" for indirect contribution to battlefield effectiveness.

(c) Notionally, the results of such a Magnitude Estimation Technique generally produce results as shown in Figure 3.8. Area A would represent those E/I whose estimate of perceived worth were ranked consistently high by the respondents as a group. Area B would represent those items where the respondents were somewhat indifferent with respect to which E/I contributed more than another; but they all agreed that the perceived worth of these E/I in this area are not consistently high or low. Area C would represent those items whose estimations of perceived worth were consistently low. If on the other hand the plot of the three areas for all 65 E/I resulted in one single horizontal straight line, then one could conclude either that no real consensus existed among the respondents (and the responses "balanced" out to the points on the line), or everyone agreed that all 65 E/I were equal in their perceived worth.

²⁸ TRADOC Pamphlet 525-66, Military Operations- FUTURE OPERATIONAL CAPABILITY, 1 May 97.

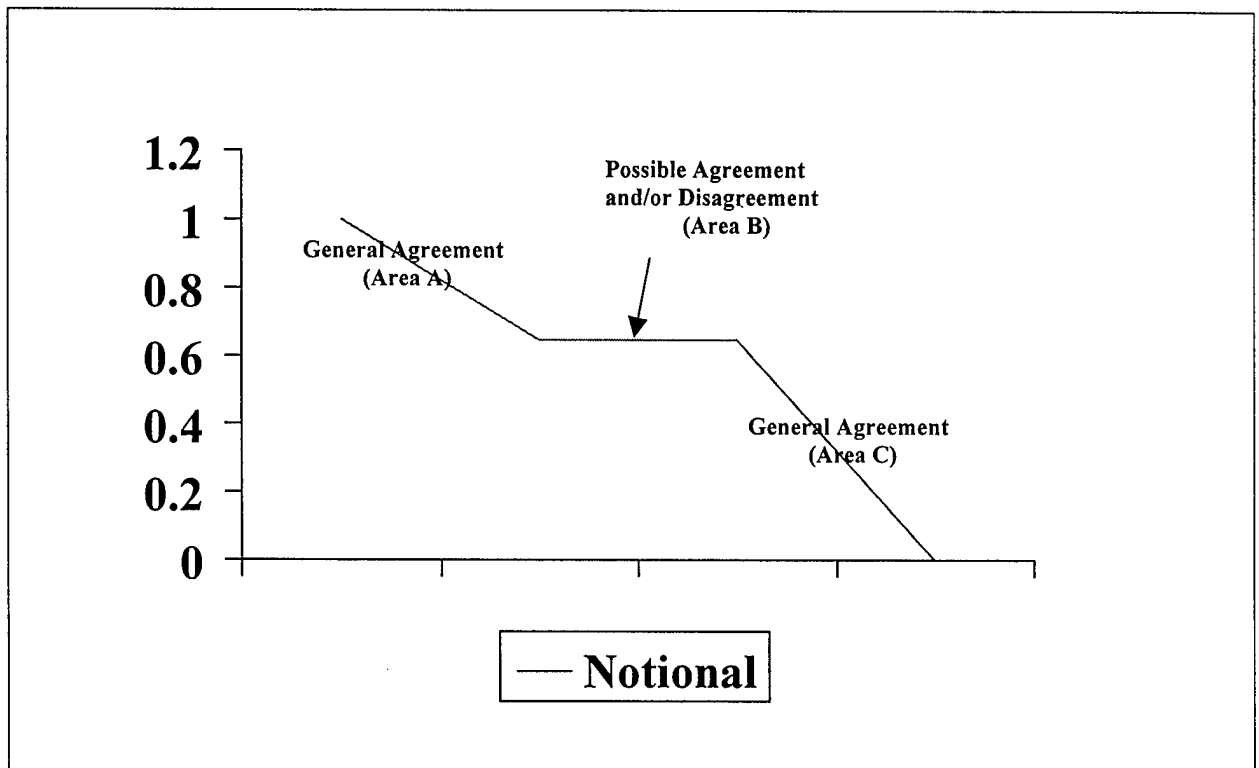


Figure 3.8. Notional Example of Magnitude Estimation Technique

(d) Results of the TRAC-LEE cardinal ranking process produced a Magnitude Estimation plot as shown in Figure 3.9, with all of the 65 E/I cardinal scores summing to "26.66." Refer to Tables 3-5 through 3-7 (pages 3-32 through 3-34) for the computed cardinal score for each E/I. Following the structure as discussed in the above notional example, responses by the TRAC-LEE analysts were consistent with expected results obtained from application of this technique. As can be seen, there was general agreement among all analysts concerning the relative perceived worth of each E/I. Figure 3.9 tends to indicate that there was no Area B set of E/I where the respondents were indifferent with respect to which item contributes more than another.

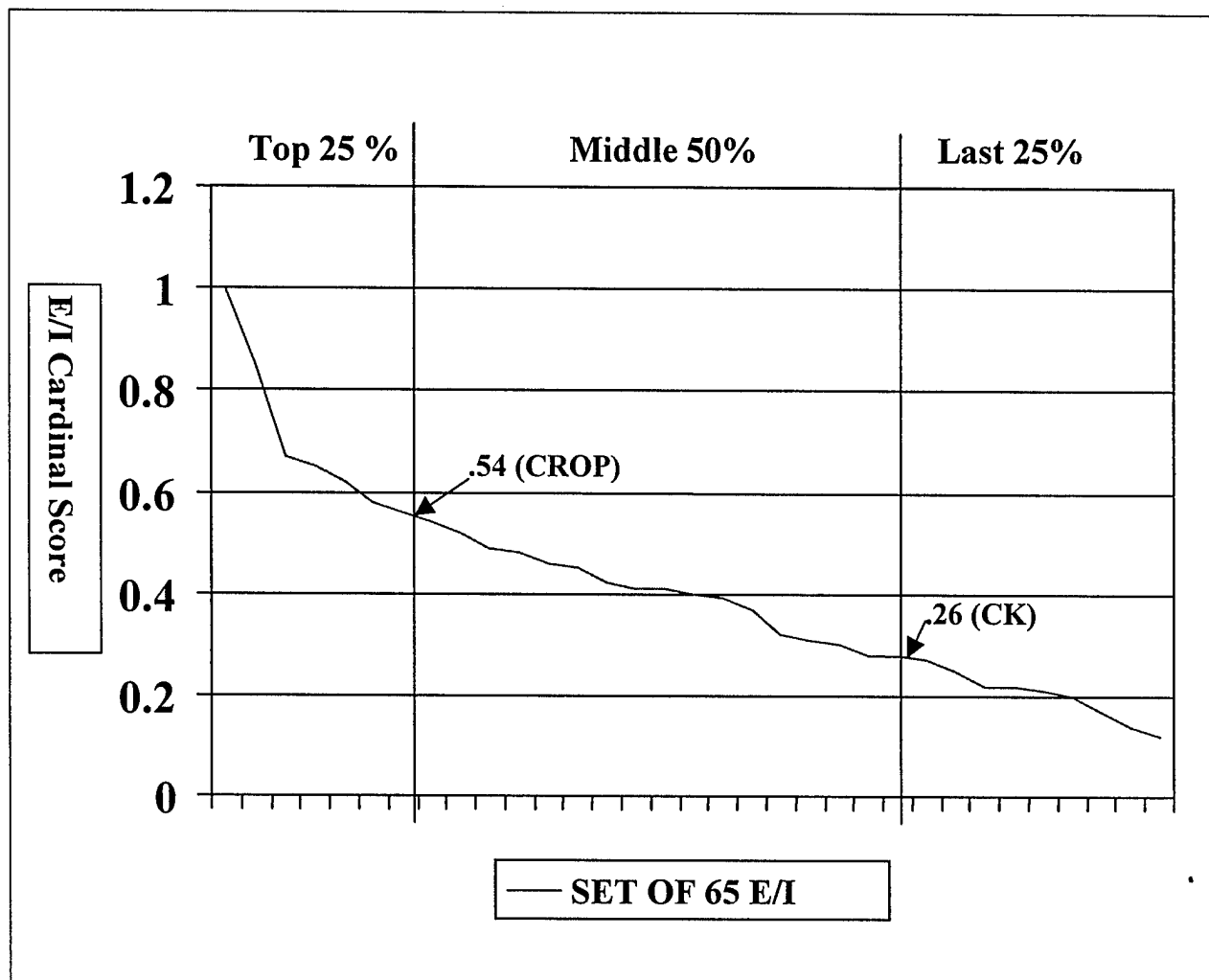


Figure 3.9. TRAC-LEE Magnitude Estimation Plot

(e) As a result of the cardinal ranking, not all of the 65 E/I were considered equal in their perceived worth, as thought of in terms of indirect contributions to battlefield effectiveness. FBCB2-CSS Functionality was thought to be the greatest contributor and mathematically received the maximum score of one (1.0000). The remaining 64 E/I each received a cardinal score representing their individual “perceived worth” value, with each score being less than the maximum value of one (1.000). Using these scores, the study team then determined what the perceived worth would be for those E/I belonging to each of the four aforementioned fielding schedules (By FY 00 [First Digitized Division], By FY 06 [First Digitized Corps], By FY 10 [end of FXXI period], and After FY 10). The following paragraphs describe these contributions. (It should be noted that what follows is based on one set of responses from experienced, civilian CD Operations Research Analysts. It is conceivable that a different set of “perceived worth” values could have been derived, had the original plan of using the CSS DCD been carried out.)

(f) First Digitized Division (By FY 00) set of FXXI CSS E/I. This set consists of the E/I detailed in the box below. The number in parentheses next to each E/I is a surrogate for its perceived worth in terms of its estimated indirect contribution to battlefield effectiveness. The reader is reminded that FBCB2-CSS Functionality was judged to have the highest perceived worth, and was therefore assigned the highest normalized value of one (1). All other E/I were estimated as having a perceived individual worth less than that of the FBCB2-CSS Functionality.

E-ORC: Fix- CMT (.4637) and ERS (.6545)

Total: (1.1182)

E: All- ICS3 (.3008).

Fix- SPORT (.4259).

Man- LADS (.1680) and TEP (.3950).

Total: (1.2897)

I: All- CSSCS (.9906) and FBCB2-CSS (1.0000).

Arm- ARS (.1405) and RONS (.2755).

Dist- CHU (.4854), MTS (.6044), RF TAGS (.6678) and TC AIMS II (.4457).

Fix- ETM (.3322) and IECU (.1647).

Man- CK (.2579) and FMS (.5752).

Total: (5.9399)

TOTAL: (8.3478)

(g) First Digitized Corps (By FY 06) set of FXXI CSS E/I. This set includes those for the First Digitized Division and the six E/I listed below.

E: Fix- EOTF (.8468) and MULTI CAPABLE MAINTAINER (.6678).

Man- ROWPU (.5675).

Total: (2.0821)

I: Arm- LIDD (.3780) and RECORM (.3273).

Fuel- PQAS (.1983).

Total: (.9036)

TOTAL: (2.9857)

(h) FXXI (By FY 10) set of E/I. This set includes those for both for the First Digitized Division AND Corps AND the one E-ORC listed in the box below.

E-ORC: Fix- HERCULES (.5410)

(i) After FY 10 set of FXXI CSS E/I. This set includes the 40 additional E/I listed below.

E-ORC: Arm- ASC (.2463) and EODRV (.4237).

Fix- FRS-H (.5576).

Man- DFBS (.4579).

Total: 1.6855

E:Arm- MOD AMMO CO (.2204).

Fix- DSC (.2793) and TEMOD (.4501).

Man- MEDLOG D (.4933).

Total: 1.4431

I: Arm- BPS (.2171), FLPT (.5218), MSS (.1967) and STEPO (.4039).

Dist- CROP (.5399), DVE (.7713), LHS (.6270), PLS-21 (.5510), and SLOT (.2782).

Fix- CBC (.1212), DRIVER MDR (.2287), FAMPS (.3747), IETM (.3091), LOF (.1697), LME (.2854), MARSS (.3091), PUMA (.3096), PUOLA (.2061), SACIMS (.3967) and VIMEPS (.2165).

Man- AIR AMB (.5218), AMEV (.4149), AMTV (.4149), DMR (.3884), FIN SOFTWARE (.4138), IMI (.4771), MC4 (.6165), MSAC (.4667), MARC (.2920), T-Med (.2661), UMT (.2066) and WPSM (.1405).

Total: 11.6530

TOTAL: 14.7816

(j) The values of the perceived worth for all the E/I summed across the four fielding periods equals 26.66 "units of worth." The graph in Figure 3.10 applies the above E/I contributions to the E, E-ORC and I fielding schedules for the First Digitized Division/Corps. Accepting the developed set of cardinal scores as surrogates for units of "perceived worth," one can see that only about one third (33 percent) of the overall perceived contribution from the entire set of FXXI CSS E/I is obtained in time for fielding the First Digitized Division (By FY 00), a cumulative 42 percent in time for the First Digitized Corps, a cumulative 44 percent by the end of the FXXI time frame (By FY 10), with 100 percent being obtained "sometime after" FY 10.

(k) The above analysis associated with fielding the FXXI CSS E/I was not intended in any way as a critique on the Army's CD/Materiel Development process, nor of the Army's return-on-investment (read "amount of contribution to battlefield effectiveness for dollars spent") for the SME-estimated E/I fielding schedules. Such would be beyond the scope of this analysis and would draw inferences far exceeding the accuracy inherent with the SME-provided risk assessments. This risk analysis of fielding schedules is provided here only to illustrate an order of magnitude for the estimated "Risk" to the First Digitized Division/Corps from FY 00-10 attributable to the FXXI CSS E/I. This risk analysis indicates that

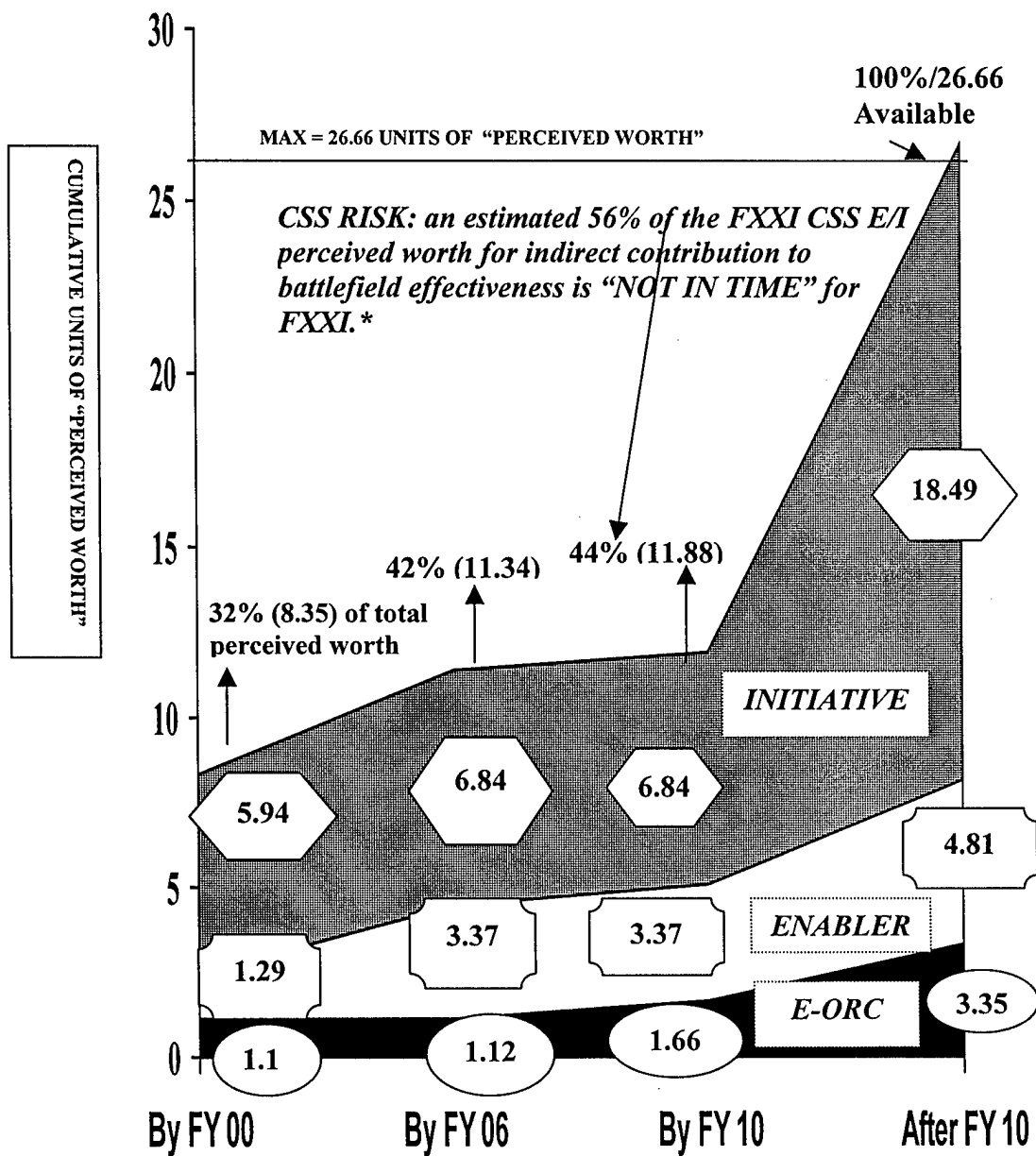
About 68 percent of the "perceived worth," as thought of in terms of indirect contribution to battlefield effectiveness, expected from fielding the entire set of 65 FXXI CSS E/I will not be realized by FY 00.

Similarly, 58 percent of the "perceived worth" will not be realized by FY 06, and

56 percent of the "perceived worth" will not be realized by the end of the FXXI time frame (FY 10).

(l) The above procedure used subjective estimates of SME-provided E/I fielding schedules combined with results of TRAC-LEE analysts' E/I ranking. By combining the above estimate from Figure 3.7 (that about 38 percent of the total set of E/I will be fielded by FY 10) with the estimate from Figure 3.10 (that these E/I represent about 44 percent of the total amount of perceived worth), one can infer that:

The E/I which are subjectively estimated as having higher perceived worth (thought of in terms of indirect contributions to battlefield effectiveness) are as a group in fact being planned for fielding during the FXXI years BEFORE other E/I with lower perceived worth.



* Estimated from the cardinal ranking of all 65 E/I by TRAC-LEE FXXI analysts.

Figure 3.10. FXXI CSS E/I Risk Over Time

i. Analysis of Systems of Systems. (The reader is referred to Appendix C, paragraph B-10a for an explanation of how the term “prerequisite” was applied in this CEFA).

(1) Figure 3.11 graphically illustrates the dependency of FXXI CSS E/I (by CSS BOS function) on prerequisites. An analysis of the 65 mini-assessments contained in Volume II indicated that 26 of the 65 FXXI CSS E/I were in some way dependent on

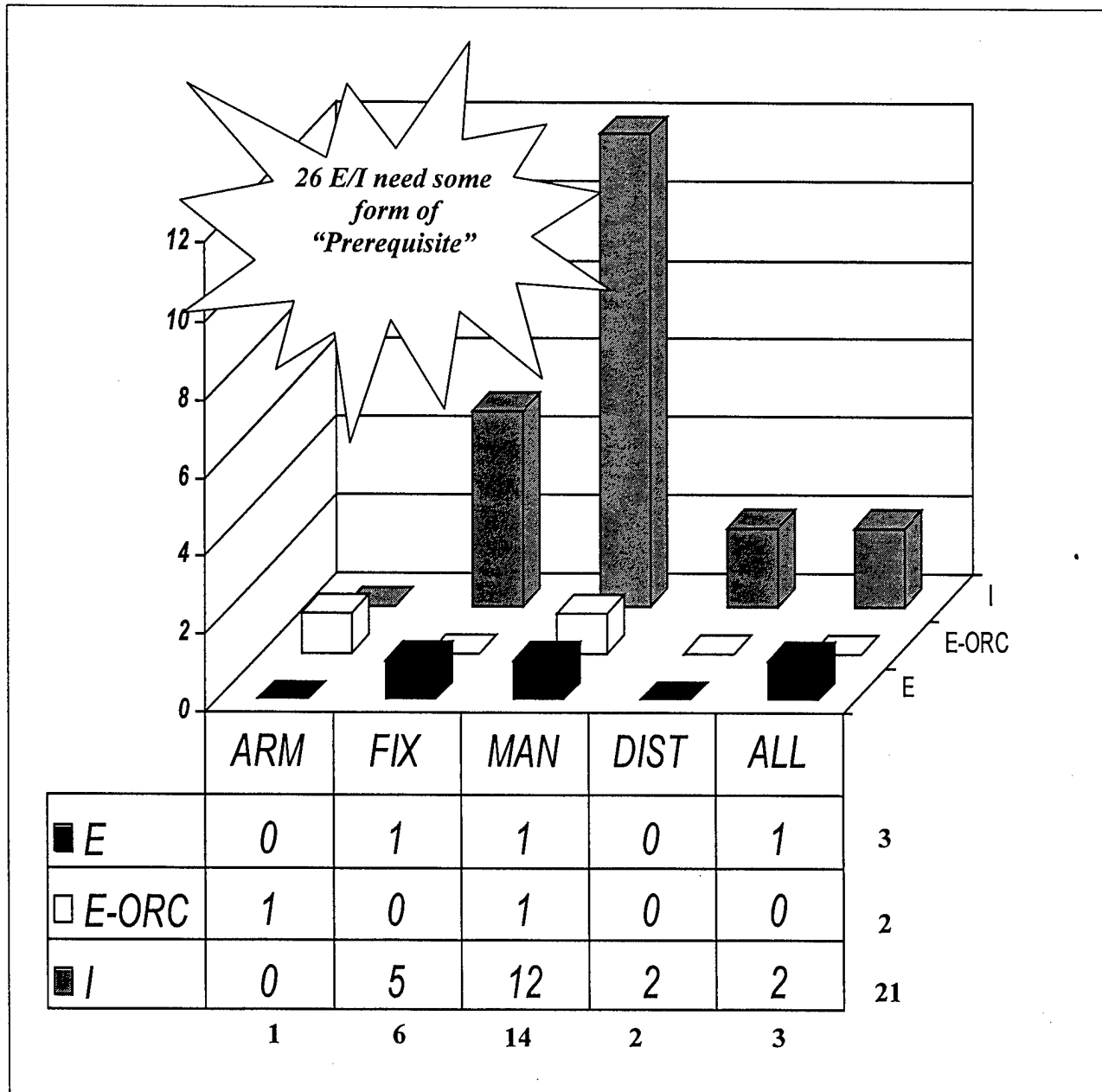


Figure 3.11. Prerequisite Count by CSS BOS Function

other known FXXI CSS E/I and/or other systems (generally communication related). The specific 26 E/I were identified earlier in Tables 3.2, 3.3, and 3.4 of this chapter. However, only one E/I, namely the EODRV, was estimated to be "risk dependent" on its prerequisite. The EODRV's mini-assessment indicates that the SME felt that the EODRV has an overall risk rating of "Red" primarily due to its dependence on the SME-identified MTS prerequisite. SME indicated that current plans do not call for fielding the MTS to non-PLS vehicles. The EODRV would otherwise have been rated as "Amber" due to lack of funds if no prerequisite were needed, OR the MTS risk were somehow mitigated. It should also be noted that for some other E/I, if their overall "inherent" risk rating (i.e., that part of their risk not influenced by "prerequisite risk dependencies") was somehow to be mitigated, such that the inherent risk became less than the prerequisite risk, then these E/I could immediately become "risk dependent" on their prerequisites, as is the EODRV now. As shown, the Fix (Maintenance) and Man (Medical, Finance, Personnel and UMT) CSS BOS functions are more dependent on prerequisites than the ARM, DIST, and All categories.

The Man function alone accounts for a little more than 50 percent (14/26) of those E/I dependent on prerequisites of some form. Also note that Figure 3.11 does not list the Fuel CSS BOS function as requiring any prerequisites.

(2) Figure 3.12 graphically illustrates which E/I depend on which prerequisites. One can observe that

- (a) FBCB2-CSS Functionality is needed for many different systems (medical, maintenance, UMT). It should be noted that FBCB2- CSS Functionality is estimated by its proponent SME as being fielded in time for both the First Digitized Division and Corps.**
- (b) Battlefield communications are necessary for practically every CSS functional area.**
- (c) The effectiveness of other individual functional areas, especially medical, relies on multiple risk dependencies.**

j. Analysis of the First and Last 25 percent of the Ordinal Ranked Set of FXXI CSS E/I

- (1) First 25 percent of the FXXI CSS E/I. As a result of TRAC-LEE analysts' subjectively rank ordering (ordinal) the set of 65 E/I, five ties occurred (refer to Appendix F): 5th place: RF TAGs and Multicapable Maintainer; 16th place: FLPT and Air Ambulance; 27th place: AMEV and AMTV; 38th place: IETM and MARSS; and 59th place: WPSM and ARS). Consequently, the 65 E/I occupied only 60 ordinal rankings. The top 25 percent of these 60 would encompass the first 15 rankings. Table 3.5 summarizes those 16 E/I (note that two E/I were tied for fifth place) ranked (ordinal) from the highest, FBCB2-CSS Functionality, to #15, the CROP. Out of the numerous stratifications that could be performed on these 16 items (e.g., by E, E-ORC and I; by Fielding Schedule; etc.), the study team elected to review only this set by its estimated "perceived worth" (i.e., the sum of each of the cardinal weights [surrogates for E/I indirect contribution to battlefield effectiveness]- refer to paragraph 3-3h in this chapter).

Table 3.5. Top 25 percent of the Ranked E/I

ORDINAL RANK	CARDINAL SCORE (Weight)	TITLE	OVERALL RISK	FIELD BY FY 2010?
1	1.0000	FBCB2 -CSS Functionality)	A	Y
2	.9906	CSSCS	G	Y
3	.8468	EOTF	A	Y
4	.7713	DVE	A	UNK
5	.6678 **	RF TAGS	G	Y
5	.6678 **	Multicapable Maintainer	A	Y
6	.6545	ERS	A	Y
7	.6270	LHS	A	UNK
8	.6165	MC4	R	UNK
9	.6044	MTS (PLS)	A	Y
10	.5752	FMS	A	Y
11	.5675	ROWPU	G	Y
12	.5576	FRS-H	R	UNK
13	.5510	PLS-21	A	UNK
14	.5410	HERCULES	G	Y
15	.5399	CROP	A	UNK

Total: 10.7789

(2-R; 10-A; 4-G) (10-Yes)

Percentage of entire amount of "Perceived Worth." (10.7789/26.66 = 40 percent)

As shown, this set of 16 E/I comprises about 40 percent of the total perceived worth of all the FXXI CSS E/I indirect contribution to battlefield effectiveness, and SME estimated that about 10 of these 16 different E/I would be fielded by FY 10 (end of the FXXI time period).

(2) Last 25 percent of the FXXI CSS E/I. Table 3.6 summarizes the lowest ranked set of 16 E/I. Note that two E/I (WPSM and ARS) were tied for second to last place.

Table 3.6. Bottom 25 percent of the Ranked E/I

ORDINAL RANK	CARDINAL SCORE (Weight)	TITLE	OVERALL RISK	FIELDED BY FY 2010?
46	.2579	CK	G	Y
47	.2463	ASC	A	N
48	.2287	Driver Minder	A	UNK
49	.2204	Mod Ammo Co	A	UNK
50	.2171	BPS	A	UNK
51	.2165	VIMEPS	A	UNK
52	.2066	Unit Min.Team	R	UNK
53	.2061	PUOLA	R	N
54	.1983	PQAS	A	UNK
55	.1967	MSS	A	UNK
56	.1697	LOF	R	UNK
57	.1680	LADS	G	Y
58	.1647	IECU	A	Y
59	.1405 **	WPSM	R	UNK
59	.1405 **	ARS	G	Y
60	.1212	CBC	A	UNK

Total: 3.0992

(4-R; 9-A; 3-G) (4-Yes)

Percentage of entire amount of "Inherent Worth:" $(3.0992/26.66 = 12 \text{ percent})$

As shown, this set of 16 E/I comprises about 12 percent of the total perceived worth of all the FXXI CSS E/I indirect contribution to battlefield effectiveness, but SME estimated that only four of these 16 different E/I would be fielded by FY 10.

(3) A subjective comparison of these two groups (Tables 3.5 and 3.6) tends to indicate that the top ranked 16 E/I are (a) estimated to provide about three times (40 percent compared to 12 percent) as much in "indirect contribution to battlefield effectiveness" as the bottom ranked 16 E/I, "AND" (b) will have more E/I planned for fielding (ten compared to four) within the FXXI period (by FY 10).

k. Analysis of the Middle 50 percent of the Ordinal Ranked Set of FXXI CSS E/I. Table 3.7 lists the middle 50 percent of the ranked E/I. Note that two E/I (FLPT and Air Ambulance) were tied for 16th place; two (AMEV and AMTV) were tied for 27th place; and two (IETM and MARSS) were tied for 38th place. As shown, this set of 33 E/I

Table 3.7 Middle 50 percent of the Ranked E/I

ORDINAL RANK	CARDINAL SCORE (Weight)	TITLE	OVERALL RISK	FIELDED BY FY 2010?
16	.5218 **	FLPT	R	UNK
16	.5218 **	Air Amb.	R	UNK
17	.4937	MEDLOG-D	A	UNK
18	.4854	CHU	A	Y
19	.4771	IMI	R	UNK
20	.4667	MSAC	R	UNK
21	.4637	CMT	G	Y
22	.4579	DFBS	A	UNK
23	.4501	TEMOD	A	UNK
24	.4457	TC AIMS II	A	Y
25	.4259	SPORT	A	Y
26	.4237	EODRV	R	UNK
27	.4149 **	AMEV	R	UNK
27	.4149 **	AMTV	R	UNK
28	.4138	FI Smart Card	A	UNK
29	.4039	STEPO	A	UNK
30	.3967	SACIMS	A	UNK
31	.3950	TEP	A	Y
32	.3884	DMR	A	UNK
33	.3780	LIDD	A	Y
34	.3747	FAMPS	R	UNK
35	.3322	ETM	A	Y
36	.3273	RECORM	A	Y
37	.3096	PUMA	R	UNK
38	.3091 **	IETM	R	UNK
38	.3091 **	MARSS	A	UNK
39	.3008	ICS3	G	Y
40	.2920	MARC	A	UNK
41	.2854	LME	A	N
42	.2793	DSC	A	U
43	.2782	SLOT	A	UNK
44	.2755	RONs	A	Y
45	.2661	T-Med	A	UNK

Total: 12.7784

(10-R; 21-A; 2-G) (10-Yes)

Percentage of entire amount of "Inherent Worth": (12.7784/26.66 = 48 percent)

comprises about 48 percent of the total perceived worth of all the FXXI CSS E/I indirect contribution to battlefield effectiveness, but SME estimated that only 10 of these 33 different E/I would be fielded by FY 10.

1. Analysis by FXXI Type (Digitization, Modernization or Both). Refer to Table 3.8 below. The following analysis reviews the set of 65 E/I from three mutually exclusive viewpoints; i.e., those E/I which are (a) "Digitization-" meant to categorize those E/I which are primarily information systems/computerization ("digits") related (e.g., CSSCS); (b) "Modernization-" meant to be those non-digitization related E/I aimed at either upgrading the capabilities of already-fielded items, generally equipment (e.g., CROP), or brand new equipment items; and (c) "Both-" meant for those E/I which are modernization efforts which also include some form of computerization (e.g., RF TAGS). This side analysis does not identify which specific E/I relates to these three categories. Rather, the reader can refer to paragraph 4 of each of the 65 mini-assessments contained in Volume II to determine which specific E/I relates to a given "Type." Table 3.8 summarizes this effort.

(1) Total Digitization Effect. As can be seen in column (2) of Table 3.8, a large majority (39 [60 percent]) of the planned FXXI CSS E/I contains some form of computerization (are "Both") as part of FXXI force modernization. About 22 (34 percent) of the E/I are "Modernization" type items, and about 4 (6 percent) are "Digitization" type items.

Thus, the combined categories of "Digitization" and "Both" represent 43 (about 66 percent: (4 D [6 percent] + 39 E [60 percent]) of the 65 E/I. This combination illustrates the total digitization effect associated with fielding the FXXI CSS E/I, and agrees with the overall FXXI transition of our military from "an industrial age army to an information age force."²⁹

(2) Fielding by FY 10. Refer to the column numbered "(3)" in Table 3.8, which concerns the number of E/I fielded during FY 98-10. The SME estimated that only 17 (2-D and 15-B) out of the combined 43 (4D and 39B) E/I (about 40 percent) of the FXXI CSS E/I employing some form of digitization will be fielded by FY 10. One may note (refer to column (6) of Table 3.8) that all (100 percent) of those E/I estimated as not being fielded by FY 10 are rated as Overall Red or Amber.

Conversely, about 60 percent of the FXXI CSS E/I employing some form of digitization will not be fielded (FUE) by FY 10.

²⁹ ARMY FOCUS 96- FORCE XXI, America's Army In The 21st Century, 1994, GEN Sullivan and the Honorable Togo West.

Table 3.8 Analysis by FXXI Type (Digitization, Modernization or Both)

Type (1)	# / % of E/I (2)	# / % Fielded in FY 98-10 (3)	# / % of Fld'd in FY 98-10 with Overall Risk of Red/Amber (4)	# / % Not Fielded in FY 98-10 ([2] – [3]) (5)	# / % of Not Fld'd By FY 98-10 with Overall Risk of Red/Amber (6)
D	4 / 6%	2 / 50%	2 / 50%	2 / 50%	2 / 100%
M	22 / 34%	8 / 36%	4 / 50%	14 / 64%	14 / 100%
B	39 / 60%	15 / 38%	13 / 87%	24 / 62%	24 / 100%
Totals:	65 / 100%	25 / 8%	19 / 76%	40 / 62%	40 / 100%

m. Analysis By Changes (Increase/Decrease) in Force Structure Requirements (Manpower, Equipment and Organization). Table 3.9 summarizes the distribution of the

Table 3.9. Changes in Force Structure BY E/I Type

	Title	Over- all Risk	Type	CSS BOS	MPWR		EQUIP		ORG		Fld'd by FY 2010
					Dec. in MPWR Reqmts	Inc. in MPWR Reqmts	Dec. in EQUIP Reqmts	Inc. in EQUIP Reqmts	Dec. in Org Reqmts	Inc. in Org Reqmts	
1	DFBS	A	E-ORC	Man				Yes			UNK
2	DMR	A	I	Man				Yes			UNK
3	DSC	A	E	Fix	Yes						UNK
4	EOTF	A	E	Fix	Yes		Yes				Yes
5	ERS	A	E-ORC	Fix	UNK		Yes				Yes
6	ICS3	G	E	All	Yes						Yes
7	IECU	A	I	Man			Yes				Yes
8	IMI	R	I	Man		Yes		Yes			UNK
9	LADS	G	E	Man	Yes						Yes
10	MC4	R	I	Man		Yes	Yes				UNK
11	MEDLOG-D	A	E	Man	Yes		Yes		Yes		UNK
12	Mod Ammo Co	A	E	Arm	Yes			Yes		Yes	UNK
13	Multicap. Maintainer	A	E	Fix	Yes		UNK				Yes
14	RONS	A	I	Arm				Yes			Yes
15	ROWPU	G	E	Man	Yes						Yes
16	SPORT	A	E	Fix	UNK		Yes				Yes
17	TC AIMS II	A	I	DIS T			Yes				Yes
18	T-Med	A	I	Man		Yes					UNK
19	TEMOD	A	E	Fix			Yes				UNK
20	TEP	A	E	Man			Yes				Yes
21	UMT	R	I			Yes					UNK
22	WPSM	R	I	Man			Yes				UNK
				TOTAL	8	4	10	5	1	1	11-Y; 11- UNK

22 E/I estimated to increase or decrease force structure. Note: as discussed in paragraph B-20a of Appendix C, equipment increases are those exclusive of the actual introduction of the equipment associated with the definition of the given E/I. As seen in Table 3.9 eight E/I (Fix: DSC, EOTF and Multicapable Maintainer; Arm: Mod. Ammo Co.; Man:

LADS, MEDLOG-D and ROWPU; All: ICS3) are estimated to decrease manpower requirements. (The reader should keep in mind that some items were defined to be "Enablers" only because they will decrease "equipment" requirements.) Only five of these will likely be fielded by FY 10; i.e., the EOTF, ICS3, LADS, Multicapable Maintainer and ROWPU.

It should be noted that of these particular five E/I that will reduce manpower requirements and be fielded by FY 10, only two belong to the FIX CSS BOS function (i.e., EOTF and Multicapable Maintainer). The third and only remaining Fix E/I (i.e., DSC) that will likely reduce manpower requirements is estimated to be fielded sometime after FY 10.

Also, four other E/I are estimated to "INCREASE" manpower requirements (all in the Man area: T-Med, UMT, IMI and MC4). None of these latter four is estimated to be fielded (FUE) before FY 10.

n. Analysis of Changes in Manpower Requirements and Efficiencies/Effectiveness as Supported by Analytical Studies. As discussed in the Nov 90 GAO report "...Army personnel involved in the AOE study explained that some decisions had been based on the professional judgment of task force members rather than on analytical data. Because of this and other factors, it was always the intent of this study effort to capture the basis for the SME responses. Early written CEFA study guidance necessitated requesting copies of any completed (approved/unapproved) analytical studies and test reports that would support the SME responses. Question #16 of the CEFA questionnaire (refer to Appendix C, paragraph B-16) also requested information on "Supporting Analytical Studies."

(1) A tally of the responses to question #16, as contained in the 65 CEFA mini-assessments (Volume II), indicates the following: SME for 23 of the 65 E/I (about 35 percent) responded in some manner that analytical studies existed to support some part of their responses, primarily those concerning decreases in manpower requirements and increases in efficiencies/effectiveness specifically attributable to fielding their given E/I. However, many SME did not know if such studies had been approved, and frequently could not locate copies for the study team. Only in a few cases were analytical studies provided. In many instances, SME indicated that their MJ formed the basis for their responses.

It should be noted that many of the proposed FXXI CSS E/I are very early in their developmental stages. Consequently, it is probable that some of these would in fact not have “quantitative” data to support statements about decreases in manpower requirements or increases in E/I efficiency/effectiveness.

Unless supporting analyses were provided the study team, we assumed that the SME responses were based on their MJ. In several other instances SME responded that quantified data were not required to be available, since their specific E/I did not have to have any supporting Analysis of Alternatives (AoA). Reference was sometimes made to a 20 May 93 CDR, TRADOC message entitled “Cost and Operational Effectiveness Analysis” (COEA), which limited the analysis required for Acquisition Category (ACAT) III and IV systems. However, research by the study team disclosed that TRADOC Regulation 71-9³⁰ reads “...if the Management Decision Authority does not require an AoA for an ACAT III or IV program, the Combat Developer or Training Developer must still maintain an audit trail of the analyses supporting the materiel need determination and providing the analytic underpinning for the operational requirements document. This same document in paragraph 9-8b(3) also continues with “...Studies proposed for contractor support are reviewed by HQ TRADOC to see if they can be supported by ‘in house’ resources in lieu of contracts. The decline in resources however has forced all contract study funding requirements for Deputy Chief of Staff for Combat Developments (DCSCD- HQ TRADOC) to be treated as unfinanced requirements and subsequently considered for funding on a case-by-case basis or through support from the Product Manager (PM) or Materiel Developer.” These issues in part contributed to limiting the SME responses in some cases to primarily their MJ.

(2) Decreases in Manpower Requirements.

(a) As it relates to the eight E/I that are estimated to reduce manpower requirements (reference paragraph 3-31), information contained in the Vol II CEFA mini-assessments indicates that:

(i) For ICS3, some analysis had previously been done but it did not specifically quantify any reductions in Division-level manpower requirements. This SME response was provided to the study team before the Sep 97 CASCOM decision that a reduction of about 25 manpower requirements may now be possible due to fielding ICS3. The study team is not aware of any analysis to support the proposed reduction of 25.

(ii) For the ROWPU, no supporting analysis was required for the expected Division-level reduction of five manpower requirements.

³⁰ Draft TRADOC Reg 71-9, “Force Development, Requirements Determination”, page 61, paragraph 9-3c(8), 19 Mar 97.

(iii) For MEDLOG-D, no analysis was available to support the Division-level expected reduction of nine manpower requirements.

(iv) For LADS which is an Echelon Above Division (EAD) system (General Support Field Service Company), supporting analysis was available. The SME estimated that the Army would realize a reduction of about 260 manpower requirements across all four Force Packages.

(v) For EOTF, analysis did exist to support a reduction of anywhere from nine to 23 manpower requirements depending on the Division-level EOTF employment scheme.

(vi) For DSC, analytical studies concluded that its fielding will cause significant reductions in maintenance manhours to flight hour requirements. But, quantified estimates of these reductions are not available at this time. The DSC may have to be fielded before actual data for reductions can be realized.

(vii) For Modular Ammo Company, in 1996 CASCOM conducted a cost analysis to support the change from an AOE Ammo Company to the new Modular Ammo Company. In May 97 the Deputy CDR, TRADOC approved the new concept. However, any planned reductions in manpower requirements will probably not be at Division-level, as the Modular Ammo Company is an EAD unit.

(viii) For the Multicapable Maintainer,

- In 1993 an Ordnance Corps Skill Consolidation study was performed. It recommended the merger of several Career Management Fields (CMF) 63 Military Occupational Specialties (MOS), and was approved by the then Chief of Ordnance and CDR, CASCOM.
- Fielding the Multicapable Maintainer will decrease the overall number of Ordnance personnel. Analysis to compute the magnitude of the overall saving has not been developed as decisions on EAD structure are still pending. Initial milestones for designing the support structure for FORCE XXI did not permit time for detailed analysis. By merging the organizational and direct support maintenance activities it was estimated that approximately 80-90 mechanics positions per brigade could be deleted. The logic for making the decrease was merger of the maintenance levels would allow for reduction in maintenance supervisors. Follow on analysis focused on reduction in indirect productive time and incorporated subjective values for Force XXI enablers. Currently 840 hours are allocated by MARC calculations for indirect productive time.

Linking the Multicapable Mechanic to communication devices that provided access to onboard sensors, diagnostic tools, the supply system, as well as maintenance management automation, and equipping the personnel with mobile maintenance platforms able to keep pace with supported units could reduce indirect productive time by up to 75 percent. There was no attempt to analyze direct productive time because there are no ongoing equipment design improvements that will allow for any reductions to maintenance allocation chart tasks.

- CDR, CASCOM briefed CDR, TRADOC on 3 Apr 97 that there is the potential to realize "up to 273" Division-level reductions in manpower requirements attributed to the new Multicapable Maintainer.
- Further, one should note that the planned reduction in the new Multicapable Maintainer's indirect productive time is heavily dependent on the synergistic benefits expected to be derived from the fielding of other FXXI CSS E/I. Yet, this CEFA estimated that by FY 10 only the following FIX E/I will be fielded: by FY 00- CMT, ERS, SPORT, ETM and the IECU; by FY 06- EOTF; and by FY 10- the HERCULES. Other E/I can assist the Multicapable Maintainer such as the CSSCS, ICS3, and FBCB2-CSS Functionality, all of which will begin fielding to some extent by FY 00. Of interest, however, is the fact that the SME estimated that the Multicapable Maintainer concept itself will likely not be fielded by FY 00. Rather, that all the affected Ordnance MOS should be in place by FY 04, which is already half way through the FXXI time frame of FY 98- 10.
- Some other maintenance-related E/I that synergistically could help the Multicapable Maintainer are such items as: TEMOD (rated by CEFA as overall "Amber"), FAMPS ("Red"), PUMA ("Red"), Driver Minder ("Amber"), SACIMS ("Red"), IETM ("Amber"), MARSS ("Amber"), and the Light Weight Maintenance Enclosure ("Amber"). As discussed in paragraph 3-3g(5), none of these is expected to be fielded before FY 10.

(b) In addition to developing the 65 CEFA mini-assessments, the study team reviewed articles and other items of information relating to the subject of manpower requirements which may be of benefit to the reader.

(i) The Jan 97 edition of Government Review³¹ contained an article entitled "Biting The Bullet"; herein one finds: "In announcing last Nov that he would not force the Army to cut 20,000 soldiers in fiscal 1997, Defense Secretary Perry noted the importance of the Force XXI effort to the Army's ability to live within future budgets."

³¹ GOVERNMENT REVIEW, Mr. James Kitfield, page 20, Jan 97.

The article went on to quote Mr. Perry as saying "We accept the Army's argument that with the requirements they are facing today, they cannot and should not cut force structure or cut capability...But I asked them to look very carefully at whether the introduction of new technology and new organizational approaches could allow them to reduce personnel while maintaining force structure and maintaining or increasing capability."

(ii) The 31 Mar 97 edition of TIME magazine³² contained an article entitled "Wired For War" in which it discussed the Army's efforts to computerize its force. The article reads in part "Congress is paying close attention to the Army's efforts. If they succeed, some lawmakers say, the Army might be able to do a lot more with far less. Richard Perle, a top Pentagon strategist in the Reagan Administration, says the Army's trade of "manpower for technology" could ultimately cut in half the service's force of 495,000 soldiers."

(iii) In Mar 97 the study team obtained a draft copy of a US Army Force Management Support Agency study entitled "Manpower Requirements Criteria (MARC) Study Document for CSS Automation Management Office (CSSAMO)."³³ The purpose of this study was to establish a MARC for staffing a CSSAMO, with the criteria applicable to personnel requirements for units operating in the Division, Corps and Echelon Above Corps (EAC) areas. The CSSAMO provides system support for CSS STAMIS and CSS C2 software operating on microcomputers in Army TOE units. The CSSAMO focuses on software support at the operator level, system trouble shooting, management of CSS software, planning and interfacing with signal support. The draft report concludes that "...This study resulted in the following position requirements: (1) One commissioned officer section chief per operating section, (b) One Warrant Officer technical advisor per operating section, (c) One senior Non-Commissioned Officer (NCO) first line supervisor and assistant technical advisor, and (4) Variable position requirements for CSSAMO operations based on annual man-hours required to perform each function in the work order..."

...Impact on Force Structure. New criteria increases (sic) all CSSAMO by various amounts depending on location. This causes an overall increase of 494 positions in force structure based on Total Army Analysis (TAA) 03."

(iv) What follows is "an opinion of one." In Dec 96 when the study team was at HQ TRADOC discussing the very earliest preparatory stages of this CEFA, a senior staff officer then deeply involved with planning for upcoming AWEs wrote that

³² TIME, page 73, 31 Mar 97.

³³ Draft report entitled MARC Study Document for CSS Automation Management Office, US Army Force Management Support Agency, copy obtained by the study team in Mar 97.

"...One of the big selling points with many of these enablers (with the term "enablers" used generically to mean early versions of any CSS enablers/initiatives) was that they would allow the Army to do the job better and save manpower. In many cases, the technical version is more difficult and complex than the manual version. This is most contentious in the CSS and communications areas. High tech is complicated and requires skilled operators and repairers. Lots of them. CDR, TRADOC has said several times that the technical version should not be more work than the manual version. Well, it is. Every computer requires an operator and support personnel. We're more effective, but not necessarily more efficient. Some of the CSS enablers in particular have promised personnel savings. Things like the system mechanic and some of the diagnostic stuff eventually may, but right now they don't... PLS-Enhanced allows you to offload huge amounts of stuff quickly and move on instead of taking a crew of manual laborers a couple of hours to do it by hand. Personnel savings? No. It's still a two-man truck crew. You haven't saved trucks. Faster? Yes. Like I said, more effective and in this case more efficient, but no personnel savings. Basically, the enablers have replaced older systems on a one-for-one basis. The new system is better but it still requires the same number of folks to run and in many cases adds overhead. That's the dilemma. I'm sure it will get better."

(v) Throughout the conduct of this CEFA, the study team noticed that there was some reluctance on the part of certain SME to link any possible reductions in manpower requirements to their given Initiative, for fear that premature cuts in spaces would summarily be made to their functional areas.

(3) Increases in Manpower Requirements. Four FXXI CSS E/I might increase manpower requirements. Phase II of the UMT will impose an increase of four requirements at the Division-level. Medical (IMI and MC4) will impose no increase at the Division-level, but may increase manpower requirements (actual numbers to-be-determined) at each Combat Support Hospital, Medical Group and the MEDCOM. Medical (T-Med) will impose no increase at the Division-level, but may increase requirements (again, actual number to-be-determined) at each Combat Support Hospital.

(4) Increases in Efficiencies/Effectiveness. Questions # 18 and # 19 of the CEFA Questionnaire (Appendix C, paragraphs B-18 and B-19) related to determining the increase in efficiency and/or effectiveness attributable to fielding a given E/I. Study team guidance to SME generally linked the term "efficiencies" to such measures of performance as timeliness, accuracy, use of resources, etc.; and the term "effectiveness" to either the inherent effectiveness of the given E/I itself (e.g., can clean so many pounds of clothes per time period) or perhaps even to indirect contribution to battlefield effectiveness itself. Each SME was left to define what the unique "efficiencies" and "effectiveness" would be for his own system. In all 65 (100 percent) of the CEFA mini-assessments, SME responded that their E/I would in fact "INCREASE" efficiency. As for effectiveness, SME for 64 of the 65 E/I indicated that their E/I would also increase effectiveness, with the SME for the ICS3 enabler providing an "Unknown" response. However, for most of the E/I, SME could not provide quantitative estimates of even ranges (high to low) of what efficiencies and effectiveness could be expected.

Most of the SME responses focused on providing qualitative discussions of what they would expect to happen by fielding their E/I. Again, it should be noted that many of the proposed FXXI CSS E/I are very early in their developmental stages. Consequently, it is highly unlikely that many of these would in fact have supporting quantitative data.

o. Miscellaneous Findings.

(1) Reliance on Automation. A few SME provided interesting insights that relate to the vast fielding of computerized equipment and a perceived reliance of soldiers on automation. SME indicated that as the Army at large increasingly becomes more dependent on automation and mechanized equipment and the benefits they generate, they are simultaneously seeing less fielding and retention of manual backup systems. Further compounding this, they said that they are seeing a decline in the amount of training in TRADOC schools on manual backup procedures and systems. Consequently, if the new automated systems are degraded in a war, they felt that it would be very difficult for soldiers to revert to or even quickly improvise some form of manual backup system. Examination of the validity and pervasiveness of this perception is beyond the scope of this CEFA. It is presented here only to highlight the concerns of some soldiers who have recently had field experience with automated systems.

(2) This CEFA has already been the catalyst for several CASCOM reviews. When the study team briefed the former CDR, CASCOM on CEFA in both Feb and Apr 97, he was extremely interested in the number of E/I that had approved concepts/MNS and ORDs. Partially due to this study effort and In-Progress-Reviews, the former CDR, CASCOM requested that his staff review the status of requirements documents for each E/I. Further, this CEFA and its risk-related questions have instilled within staff officers throughout the CSS community a much more critical awareness of risk issues as they continue with their respective CD efforts.

p. Additional CEFA Reviews Possible by Further Stratification of the Various Risk-Related Types of Information. Limited study time precluded further reviews of the E/I as stratified, for example, by DTLOMS areas, or perhaps tailored to specific inquiries such as "Which Fix Initiatives are 'Amber' in peacetime, have no approved ORD, and which likely will be fielded by FY 2010." However, the CEFA data base generated from the SME responses and loaded into an AEPCO-developed MicroSoft ACCESS file is available upon request to any approved agency.

Chapter 4
SUMMARY, CONCLUSIONS, RECOMMENDATIONS and CLOSING
REMARKS

4-1. Summary.

a. **CEFA Study Objective.** Chapter 1(paragraph 1-3) posed the following question "What are the risks associated with the FXXI CSS E/I?" Volume II contains the CSS SME-developed risk assessments for the set of 65 DCD-approved FXXI CSS E/I. These mini-assessments identify what each SME/DCD thought to be the major risk drivers for each of their proponent E/I.

b. **CEFA Study EEA.** Chapter 1(paragraph 1-3) posed the following four EEA which taken collectively provided the substance underlying each of the 65 mini-assessments.

(1) EEA # 1: What are the FXXI CSS E/I as approved by the CASCOM CDR?
THIS QUESTION WAS NEVER COMPLETELY ANSWERED.

From Apr-Jun 97 proponent SME developed and submitted their list of FXXI CSS E/I. Early CEFA study guidance requested that before each SME submit any candidate E/I to this CEFA and perhaps expend needless time, they first acquire their DCD's approval of each candidate E/I. Assuming DCD approval, the set of SME-provided FXXI CSS E/I formed the DCD's "candidate" set of 65 FXXI CSS E/I. Once this complete list of 65 candidate E/I was compiled, the CASCOM CEFA coordinator had intended to staff it to the CDR, CASCOM for his review and approval. This was planned in response to CDR, CASCOM's request (which was independent of TRAC-LEE's CEFA study) that his approved list of FXXI CSS E/I be placed on the CASCOM's Internet Homepage. Such was fortuitous as the study team had all along planned, as a direct part of CEFA, to also have the CASCOM CEFA coordinator staff the DCD's candidate E/I to the CDR, CASCOM. The study team desired such a review since it would have resolved selected anomalies (refer to Chapter 3, paragraph 3-2e) and perhaps eliminated certain candidate E/I from inclusion in the resulting CEFA analyses. Higher CASCOM priorities precluded the CASCOM CEFA coordinator from ever acquiring the CDR, CASCOM's review and approval of the DCD's candidate E/I. After the former CDR, CASCOM retired in Aug 97, and partially due to the fact that several of the CSS DCDs were newly assigned (normal summer rotations), CASCOM then offered to restaff the compiled list of 65 E/I back to the CSS DCD for another review, prior to then staffing perhaps a newer/updated list of 65 FXXI CSS E/I to the new CDR, CASCOM. Given that the CSS SME (and the study team) had already expended extensive efforts in developing 65 mini-risk assessments, TRAC-LEE decided against the restaffing proposal given the limited amount of study time left to bring closure on this CEFA. Rather, TRAC-LEE decided to terminate this effort and to document this CEFA as a "SNAPSHOT IN TIME."

Consequently, this EEA was never completely answered. CDR, CASCOM never approved the DCD's candidate set of 65 CSS FXXI E/I.

(2) EEA # 2: What are the associated peacetime (programmatic) risks for each CSS E/I? The CEFA methodology resulted in derivation of a set of factors that tend to drive peacetime risk, along with assignments of peacetime risk ratings for each of the 65 candidate E/I. These are explained in detail in Volume II.

(3) EEA # 3: What are the wartime employment risks for each CSS E/I? The CEFA methodology resulted in derivation of a set of factors that tend to drive wartime risk, along with assignments of wartime risk ratings for each of the 65 candidate E/I. These are explained in detail in Volume II.

(4) EEA # 4: What is the basis for assessing peacetime and wartime risk considerations (Refer to the reference 1990 GAO report)? The basis for most of the SME responses was their MJ. Very few responses were supported with empirical test data and/or analytical studies. This is addressed further in each of the 65 mini-assessments contained in Volume II.

4-2. Major Study Conclusions and Associated Recommendations. Findings from Chapter 3 form the basis for the following conclusions and recommendations

a. **Conclusion #1.** Since most of the 65 FXXI CSS E/I are estimated by SME as not being fielded by FY 10, any decisions assuming the contrary, especially those impacting reductions in manpower requirements carry risk with them.

SUPPORTING DISCUSSION:

(1) Manpower Requirements.

(a) Decrease in Manpower Requirements.

(i) Enablers (Reference Chapter 3, paragraph 3-3m). Only eight Enablers are projected to decrease manpower requirements. Division-level: (1) DSC, (2) EOTF, (3) Multicapable Maintainer, (4) MEDLOG-D, (5) ROWPU, (6) ICS3. EAD-level: (7) Modular Ammo Company, and (8) LADS. Of these eight, only five will likely be fielded by FY 10. These five are: ICS3, LADS, ROWPU, EOTF and Multicapable Maintainer. Only two of these five belong to the FIX CSS BOS sub-function (EOTF and Multicapable Maintainer). Also, since both the LADS and the Modular Ammo Company are for EAD, any associated reductions in manpower requirements would likely not affect the Division-level. The study team was not provided any strong analytical basis to expect that the aforementioned six division-level enablers (let alone the four planned for fielding by FY 10) will total to the estimated 388 decrease in manpower requirements attributed

to "anticipated increases in E/I efficiencies and/or effectiveness" (Reference Chapter 1, paragraph 1-2 c).

(ii) Initiatives (Reference Chapter 3, paragraphs 3-3g and 3-3n(4). All the candidate Initiatives were estimated to likely increase efficiencies and/or effectiveness for some CSS functions, but each by definition cannot "yet" support any decrease in manpower requirements until they are tested and proven in the field. Also, only 15 (32 percent) of the 47 total number of candidate FXXI CSS Initiatives are estimated to be fielded by FY 10. Consequently, there also is little evidence to support that fielding the Initiatives will greatly mitigate (through increases in efficiencies/effectiveness) the risks associated with some of the estimated reduction of about 388 Division-level CSS personnel.

(b) Increases in Manpower Requirements (Reference Chapter 3, paragraph 3-3n). Four FXXI CSS E/I might increase manpower requirements. Phase II of the UMT will impose an increase of four requirements at the Division-level. Medical (IMI and MC4) will impose no increase at the Division-level, but may increase manpower requirements (actual numbers to-be-determined) at each Combat Support Hospital, Medical Group and the MEDCOM. Medical (T-Med) will impose no increase at the Division-level, but may increase requirements (again, actual number to-be-determined) at each Combat Support Hospital.

(2) Other Supporting Issues.

(a) By the end of the FXXI time frame (FY 10), SME estimate that only about 25 (38 percent) of the set of 65 candidate FXXI CSS E/I will be fielded (FUE). TRAC-LEE FXXI analysts estimated these 25 E/I to represent about 44 percent of the "perceived worth for indirect contributions to battlefield effectiveness." (Reference Chapter 3, paragraph 3-3g(5).)

(b) Sixteen of the 65 candidate FXXI CSS E/I were estimated as having a "Red" Overall risk rating. None of these 16 E/I is expected to be fielded until sometime after FY 10. (Reference Chapter 3, paragraph 3-3g(5).)

(c) By the end of the FXXI time frame (FY 10) SME estimated that only about 17 (40 percent) of the 43 E/I which rely on some form of digitization will be fielded. (Reference Chapter 3, paragraph 3-3l(2).)

(d) Notwithstanding that most E/I are not expected to be fielded during the FXXI time frame, SME could not provide quantitative estimates of related increases in efficiencies/effectiveness. (Reference paragraph 4-2b below.)

(3) Therefore, this analysis DOES NOT TOTALLY SUPPORT the overall theme of what the CASCOM briefed to the CDR, TRADOC on 3 Apr 97. One of CASCOM's briefing charts indicated the following: (Note: the study team assumes that since this chart begins with 'Enablers' and discusses in its paragraph (3) the "offsetting of

requirements or reductions in strengths over time" (both unique only to the definition of "Enabler"), that the word "initiatives" in paragraph (1) and reference to "only an insignificant few" in paragraph (2) all really refer to FXXI CSS "Enablers.")

"...BOTTOM LINE (continued)...Enablers- (1) There are significant initiatives being developed in the areas of technology, doctrine and training. (2) Only an insignificant few will reach maturity by the establishment of the first high tech division. (3) Because of the above, there can be no major offset of requirements or reductions in strength in the near term. (4) Reduction in DISCOM strength can be accomplished over time as technology, new skill and training are developed, resources produced and assimilated into the force. And (5) until then, significant downsizing will result in unacceptable level of risk to the FXXI Division's ability to accomplish its wartime mission."

(a) CEFA findings do not directly support "...only an insignificant few (assumed to mean "Enablers") will reach maturity by the establishment of the first high tech division." Rather, SME estimates indicate that about 33 percent of the proposed E and E-ORC will be fielded in time for the First Digitized Division. Refer to Chapter 3, paragraph 3-3g(2))

(b) CEFA findings do not support "...Reduction in DISCOM strength can be accomplished over time..." (The study team assumes that "over time" meant some reasonable time frame such as during the FXXI period of FY 98-10.)

(i) Enablers. The Division-level Enablers such as ICS3 (25 spaces), ROWPU (5 spaces), MEDLOG-D (9 spaces), EOTF (9 to 23 spaces), and the DSC (unknown number of spaces) might decrease around 48 to 62 spaces, not counting the DSC reductions. Also, CEFA findings related to employing the new Multicapable Maintainer do not at this time support an associated large reduction in manpower requirements. Collectively, these Enablers may not yield sufficient offsets in manpower reductions to offset the large number of manpower cuts being imposed on the new FXI CSS force structure designs. (Reference Chapter 3, paragraph 3-3n.)

(ii) Initiatives. With respect to using anticipated increases in efficiencies/effectiveness from the Initiatives to mitigate CSS manpower cuts, SME estimates indicate that only about 38 percent of the combined FXXI CSS E/I will be fielded (FUE) by FY 10. (Reference Chapter 3, paragraph 3-3g(1).)

RECOMMENDATIONS:

(1) That HQ TRADOC and the CSS community reassess any ongoing FXXI cuts in CSS spaces attributed to planned reductions in manpower requirements due specifically to fielding the FXXI CSS E/I. These reductions are asserted to accrue from

hypothesized increases in efficiencies/effectiveness attributable to fielding the new FXXI CSS E/I.

(2) That if not yet accomplished, CASCOR publish a report which contains the audit trail and rationale for the decisions surrounding their new FXXI CSS redesigns. This would include where manpower cuts are proposed (a) as a result of having gone from the AOE division-level CSS organizations to the new FXXI redesigns, and (b) in anticipation of planned E/I fielding benefits.

(In their Nov 1990 report³⁴ GAO indicated that DOD agreed with their earlier recommendation that the Army fully document the basis for major changes in its force designs as it proceeded to restructure its force (from, at that time, Division 86 to AOE). However, GAO wrote "... DOD agreed with our recommendation but believed that the Army was already documenting force structure changes and risks through its normal force structure review process... While we (GAO) agree that the Army has systematically communicated force structure changes to its personnel in the field, we do not believe that the documentation that DOD cited fully captures the basis for the changes or the risks that the Army accepts in making these changes. For example, TOE that DOD cited do not clearly explain the basis for deviating from MARC in setting personnel requirements... We continue to believe that the Army should document, in an appropriate mechanism that is widely disseminated, the basis for changing its force designs and the risks associated with such changes.")

b. **Conclusion #2.** "Quantification" of reductions in manpower requirements and of increases in efficiencies/effectiveness is not possible at this time for most of the candidate FXXI CSS E/I.

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraphs 3-3m and 3-3n). One of the original purposes of CEFA was to input, where appropriate, the quantitative decreases in manpower and increases in efficiencies/effectiveness for each E/I into TRAC's VIC model. Such empirical data would then be used in TRAC's JV analyses along with the new FXXI CSS structures to more accurately portray the impacts of employing new FXXI CSS concepts. However, SME responses provided extremely limited quantitative data about the E/I. In many cases SME stated it was far too early in the developmental cycle of their given E/I to permit their estimating even gross parametric ranges of likely changes to CSS manpower and/or CSS efficiencies and effectiveness.

RECOMMENDATIONS:

(1) As the candidate FXXI CSS E/I become more fully developed and tested, future CEFA-like reviews should focus heavily on obtaining "quantitative" estimates of decreases in manpower requirements and increases in efficiencies/effectiveness.

³⁴ Army Force Structure- Lessons Learned to Apply In Structuring Tomorrow's Army, General Accounting Office, Nov 1990.

(2) When quantitative estimates of the expected E/I decreases in manpower requirements and increases in efficiencies/effectiveness are obtained, appropriate Army activities should then perform functional MARC studies in order to update AOE factors to better represent the impacts caused by FXXI technologies and concepts.

c. **Conclusion #3.** The following factors contribute the most to "Overall" risk: (1) inadequate funds; (2) lack of testing; (3) impacts caused by dependence on selected prerequisites; and (4) absence of one or more supporting requirements documents (Concept, MNS and ORD).

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraph 3-3e). Based on the SME assessments, the aforementioned factors were estimated to drive overall E/I risk ratings. As can be seen, these factors are all peacetime issues. Certain SME also identified, to a lesser extent, the following additional risk factors: (1) the lack of planned wartime backup systems; (2) concern over possible "increases" in manpower and/or equipment; (3) unproven technical capabilities; and (4) selected other factors.

RECOMMENDATION: That proponent DCD review the Volume II mini-assessments for each of their candidate FXXI CSS E/I. They should focus on those factors estimated to drive risk which they themselves control and can change. For example, if not already initiated, it may be possible that assigned CD staff officers' available time can be redirected towards developing requirements documents for those E/I expected to have the high "perceived worth," or for those which are prerequisites for one or more other E/I. Existence of approved concepts, MNS and ORD does not guarantee funding, but on the other hand their absence almost always guarantees no funding. Approval of requirement documents likely helps acquiring funds; funding likely helps the establishment of necessary testing programs to determine the adequacy of concepts and technical capabilities. Recall, Chapter 3, paragraph 3-3e indicated that the two leading primary risk drivers were inadequate funding and lack of testing.

d. **Conclusion #4.** Based on SME responses, five specific E/I, which ranked in the top 25 percent of all E/I in terms of their perceived worth for indirect contributions to battlefield effectiveness, will not be fielded before FY 10.

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraphs 3-3a and 3-3c through 3-3i.)

(1) These five are (1) DVE, (2) LHS, (3) CROP, (4) FRS-H, and (5) MC4, and are rated either as "Red" or "Amber."

(2) The driving risk factors for these five primarily focus on lack of funds, with MC4 also heavily dependent on "at risk" prerequisites.

RECOMMENDATION: That the DCD proponents should examine both the top and bottom 25 percent groupings of FXXI CSS E/I to determine if they have E/I in both sets which are rated other than "Green." If so, they should examine the driving risk

factors of each E/I to see if they could shift resources (e.g., funds, staff officers' time) from one or more of the E/I in the last 25 percent grouping to an E/I that is in the top 25 percent grouping AND which is not rated "Green."

e. **Conclusion #5.** Based on the CEFA estimate that about 60 percent of all the candidate FXXI CSS E/I entail some form of digitization, there will be a second order increase in manpower requirements in terms of computer maintenance personnel not directly reviewed in this CEFA.

SUPPORTING DISCUSSION: (Reference Chapter 3, paragraph 3-31 and numerous Volume II mini-assessments.) Some SME indicated that they thought there would likely be an increase in manpower requirements to repair the planned influx of automation equipment onto the FXXI battlefield for CSS support. SME opinions tend to be supported by the Chapter 3 finding that about 60 percent of the set of FXXI CSS E/I will employ some form of digitization.

RECOMMENDATION: If not already initiated, that the appropriate Army agency, in conjunction with the US Army Ordnance Center & School, begin a comprehensive examination of all the automation planned for the FXXI battlefield, not limited solely to CSS or even to the candidate set of FXXI CSS E/I. The objective of such a review would be to determine the amount, if any, of required increases in field maintenance personnel needed to repair automation related equipment, crucial for FXXI situational awareness and "Information Dominance." The US Army Force Management Support Agency's draft Mar 97 MARC Study document for CSS Automation Management Office indicated that "...In all the CSSAMO's visited, the TRAC-WSMR study team found that some form of hardware maintenance repair or replacement was performed to keep the units operational and reduce system down time. A review of the CSSAMO concept showed that maintenance of computer hardware of any kind was not included. Furthermore, the new concept for the Electronic Maintenance Company in divisions specifies that all computer hardware maintenance will be performed in this new company. Therefore, all workload attributed to computer hardware maintenance has been deleted from consideration in this study."

f. **Conclusion #6.** The DCD-approved list (never reviewed by the former CDR, CASCOM) needs to be reviewed by the present CDR, CASCOM. Such action would be to review adherence to CASCOM's 7 Mar 97 definitions for FXXI CSS E/I, or to determine if changes are required to the definitions of FXXI CSS E/I. (Reference various sections throughout this CEFA report.)

RECOMMENDATION: That if CASCOM still perceives benefit in actually defining an official set of FXXI CSS E/I for review by HQ TRADOC and HQDA, it consider institutionalizing this CEFA methodology and reviewing each of the 65 candidate E/I for adherence to CASCOM's original 7 Mar 97 definitions for FXXI E/I. Results could then serve as another analytical tool for aiding decision making in support of CASCOM's CSSMMP and WFLA reviews.

g. **Conclusion #7.** Based on the Systems of Systems subanalysis, CSS command and control systems and supporting battlefield communications are extremely important to the success of many other E/I, especially in the medical, maintenance and personnel areas. (Reference Chapter 3, paragraph 3-3i and numerous Volume II mini-assessments.)

RECOMMENDATIONS:

(1) That the CSS community review the advantages of defining/combining some of these E/I into one system for funding and testing purposes. The study team recognizes that certain elements of the Army community sometime think that developmental items can enjoy a better funding advantage if they are not combined. However, given the nature of the planned FXXI Army with major emphasis on situational awareness (read "the interaction of such systems as digitization, command and control, information, and communications"), continued stovepiped development of such E/I may impose unacceptable risks for the success of any one system.

(2) That, if not yet initiated, the CSS community immediately begin a thorough and holistic review of its FXXI communications requirements. Requirements resulting from this review should be included in the Command, Control, Communication and Computer (C4) Requirements Definition Program (C4RDP). C4RDP is the Army's validated source of Battle Command and Combat Support/Service Support information exchanges and C4 equipment distribution requirements.

4-3. Closing Remarks. This report started off in Chapter 1 by quoting from a Nov 90 GAO report, which reviewed the Army's efforts to restructure to AOE. After having discussed this CEFA in detail along with its findings and conclusions, the study team finds it appropriate to close by again presenting the same quotes in an effort to remind the reader of what GAO cautioned back in Nov 90.

(1) "...In the late 1970's, the Army adopted new force designs termed "Army 86" as a means of increasing the combat power of its divisions. However, by 1983, it had become clear that the new structure required so many people and so much equipment that the Army simply could not afford it. Hundreds of units were totally without people or equipment, and many others were seriously understaffed and under-equipped. In the words of the Chief of Staff, the Army had become 'hollow.' In the summer of 1983, the Chief of Staff directed a total redesign of Army forces. In November 1983, the Army approved a new streamlined force structure, termed the "Army of Excellence" (AOE) as its organizational blueprint for the future.

In approving the new designs, the Army sacrificed some strength in both combat and support functions and accepted more risk than it had in the past. However, Army planners emphasized that this streamlined force offered a more efficient and affordable structure."

(2) "... However, because Army planners based some key decisions on their professional judgment without adequately documenting the rationale behind them, questions continue to surface over the adequacy of the new designs (force structures)....The Army did not properly manage one major space-saving initiative- the Logistics Unit Productivity Systems (LUPS) program- which was to provide labor-saving equipment to logistical units. Because it did not ensure that these units received their required equipment and personnel and did not validate their expected gains in productivity, the Army cannot be sure that these units can perform as envisioned."

(3) "Neither the AOE reports nor internal classified reports showed what revisions had been made to the factors used in determining personnel requirements, the bases for the changes, or the personnel savings that resulted from the changes....However, another impetus toward revising these factors was a conscious decision under AOE that the Army could afford to accept the additional risk entailed in reducing requirements for some support functions..."

Army personnel involved in the AOE study explained that some key decisions had been based on the professional judgment of task force members rather than on analytical data.

For example, decisions to reduce the number or size of a specific type of unit were sometimes based on the personal experiences of the task force members. Reductions in some support functions were made in some instances because task force members believed that requirements were inflated. Other reductions were due to the decision that, whenever possible, risks would be accepted in support functions to preserve combat capabilities."

In the mid 1980's the Army community introduced what was often referred to as "AOE risk." This term was used then to subjectively describe the risk to CSS missions attributable in part to those applied decreases in manpower made in expectation of future gains in CSS efficiencies/effectiveness. It is possible that the Army may this time be introducing a "FXXI CSS risk" by again front loading decreases in manpower, this time in anticipation of future increases in efficiencies/effectiveness attributable to the FXXI CSS E/I.

Lastly, the study team recognizes what the CEFA SME so frequently reiterated; namely, that some of their proposed E/I are in their early stages of development, and may not have available much "quantitative" data to support the decisions being made today. Unfortunately, such may still leave the CSS community vulnerable to renewed GAO criticism similar to its 1990 critique of the Army's AOE redesign.

APPENDIX A

REFERENCES

REFERENCES

The following set of references document the sources that CEFA used to compile its initial list of candidates for FXXI CSS E/I. These references are on file with TRAC-LEE, and can be reviewed as needed by contacting TRAC-LEE, Mr. Jim Behne, at DSN: 539-1838; Internet address: behnej@trac.army.mil.

1. TF XXI Experiment Directive for the TF XXI Advanced Warfighting Experiment, 4th ID Experimental Control Cell, 1 Jun 96. It identified 21 CSS "Initiatives."
2. TF XXI CSS Enabler Matrix, 4th ID Experimental Control Cell (ECC), Oct 96. Identified 41 items as CSS "Enablers." It defined "CSS Enabler" as "...equipment, concepts that may reduce personnel, increase efficiency, and or increase effectiveness. They may support a concept (BD, VM).
3. Draft "CSS Operations in Support of the FXXI Division Redesign" publication, CASCOM, undated (o/a Oct 96). Chapter 4 lists materiel requirements identified as essential/critical for the Division Redesign.
4. Draft Division Design Analysis Phase II Study Plan, Sep 96, TRAC, Annex C-2 of Appendix C entitled "CSS Enablers." It identified 13 CSS "Enablers" and reads "This annex briefly describes the key CSS Enablers that will allow the FXXI Division to execute the new CSS concept. It is not intended to be an all inclusive listing."
5. Draft Division XXI Advanced Warfighting Experiment (DIV AWE XXI) Study Plan, Oct 96, TRAC, Appendix A. This section addresses an analysis issue relating to "Do the CSS technological enablers support FXXI Battle Command and Information Operations requirements?"
6. DIV AWE CSS Issues and Analysis Briefing, 25 Sep 96. It identified 13 CSS "Initiatives/Enablers."
7. Listing of CASCOM DIV AWE XXI Initiatives that support the CSS Division XXI validation, Jun 96, CASCOM. This identified 22 items as "initiatives."
8. Email, subject Warfighting Lens Analysis (WFLA) Reclama, 14 Nov 96, CASCOM. This email reads "...the key enablers (from the TRADOC Black Book and the WFLA assessments) for PROJECT and SUSTAIN are: Total Asset Visibility, Modular Organizations, Prepositioned Equipment, Integrated Logistics Automation, CSSCS, MTS, and Wireless STAMIS.
9. Listing of TF XXI Initiatives prepared by the CAMBER Corp for the TF XXI AWE 4th ID ECC, Jul 96. It lists 17 CSS "Initiatives" for the then upcoming TF XXI AWE (Mar 97).

10. CASCOM briefing entitled "CSS Force Multipliers," undated; obtained by this CEFA study team in Sep 96. It identifies 27 "Initiatives."
11. HQ TRADOC Pamphlet entitled "FORCE XXI, Land Combat in the 21st Century," undated; obtained by this study team in Jul 96. It identifies 6 CSS "Enablers", 6 CSS "Concepts," and 8 CSS-related "Technologies."
12. CSS Materiel Master Plan, Sep 96, CASCOM. It identifies the "near-, mid-, and long term 'enablers' needed to achieve required operational capabilities..." This document served to initially identify numerous "enablers" for the CEFA.
13. Email for AMEDDC&S, Subject: Medical Enablers for FXXI, 21 Nov 96.
14. CASCOM briefing presented to Deputy TRADOC CDR entitled "TF XXI Update, 29 Apr 96.
15. CSS Technology Vision for Army After Next, CASCOM, 27 Aug 96.
16. CASCOM COMMANDANT's CALL, 3 Dec 96, and related briefing slides.
17. Army Logistician article entitled "FXXI-Leveraging Logistics Technology Toward FXXI," Jul-Aug 95.
18. CDR CASCOM Right-size DISCOM briefing to CDR TRADOC, 3 Apr 97.
19. CDR TRADOC 201644Z May 93 message, subject: Cost and Operational Effectiveness Analysis (COEA) Procedures and Responsibilities.

LISTING OF ACRONYMS AND TERMS

AA	ABBREVIATED ANALYSIS
AAFARS	ADVANCED AVIATION FORWARD AREA REFUELING SYSTEM
AAN	ARMY AFTER NEXT
AAO	ARMY ACQUISITION OBJECTIVE
AAR	AFTER ACTION REVIEW
ABC	AIRBORNE CORPS
ABCS	ARMY BATTLEFIELD CONTROL SYSTEM
ABOB	AUTOMATED BREAKOUT BOXES
ACALA	ARMY ARMAMENT AND CHEMICAL ACQUISITION AND LOGISTICS ACTIVITY
ACAT III/IV	ACQUISITION CATEGORY
ACT II	ADVANCED CONCEPT TECHNOLOGY II
ADCSOPS	ASSISTANT DEPUTY CHIEF OF STAFF FOR OPERATIONS
ADP	AUTOMATIC DATA PROCESSING
AEPCO	ADVANCED ENGINEERING AND PLANNING CORP., INC.
AFATDS	ADVANCED FIELD ARTILLERY TACTICAL DATA SYSTEM
AFMIS	ARMY FOOD MANAGEMENT INFORMATION SYSTEM
AG	ADJUTANT GENERAL
AGCCS	ARMY GLOBAL COMMAND AND CONTROL SYSTEM
AI	ARTIFICIAL INTELLIGENCE
AIT	AUTOMATED IDENTIFICATION TECHNOLOGY
ALM	AIR LOAD MODULE
AMC	(UNITED STATES) ARMY MATERIAL COMMAND
AMEDD	ARMY MEDICAL DEPARTMENT
AMEDDC&S	ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL
AMEV	ARMORED MEDICAL EVACUATION VEHICLE
AMFT	AIR MOVEMENT FLOW TABLE
AMFT	AUTOMATED MOVEMENT FLOW TRACKING
AMTV	ARMORED MEDICAL TREATMENT VEHICLE
AMV	ARMORED MAINTENANCE VEHICLE
ANSI/ISO	AMERICAN NATIONAL STANDARDS INSTITUTE/INTERNATIONAL STANDARDS ORGANIZATION
AOA	ANALYSIS OF ALTERNATIVES
AOE	ARMY OF EXCELLENCE
APU	AUXILLARY POWER UNIT
AR	ARMOR/ (or) ARMY REGULATION
ARDEC	ARMAMENT RESEARCH DEVELOPMENT CENTER
ARL	ARMY RESEARCH LABORATORY
ARM	ARMY READINESS AND MOBILIZATION

ARPA	ADVANCED RESEARCH PROJECTS AGENCY
ARS	ADVANCED RADIOGRAPHIC SYSTEM
ASARC	ARMY SYSTEMS ACQUISITION REVIEW COUNCIL
ASAS	ALL-SOURCE ANALYSIS SYSTEM
ASC	AMMUNITION SOLAR COVER
ASL	AUTHORIZED STOCKAGE LIST
ASMC	AREA SUPPORT MEDICAL COMPANY
ASP	AMMUNITION SUPPLY POINT
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ASVAB	ARMED SERVICES VOCATIONAL APTITUDE BATTERY
ATA	ARMY TECHNICAL ARCHITECTURE
ATCCS	ARMY TACTICAL COMMAND AND CONTROL SYSTEM
ATCD	ADVANCED TECHNOLOGY CONCEPT DEMONSTRATION
ATCOM	AVIATION AND TROOP COMMAND
ATLAS	ALL-TERRAIN LIFTER, ARMY SYSTEM
ATP	AMMUNITION TRANSFER POINT
ATTV	ARMORED TREATMENT AND TRANSPORT VEHICLE
ATV	AUTOMATED TRANSIT VISIBILITY
AUTL	ARMY UNIVERSAL TASK LIST
AVIM	AVIATION INTERMEDIATE MAINTENANCE
AWE	ADVANCED WARFIGHTING EXPERIMENT
BAS	BATTALION AID STATION
BBS	BATTALION/BRIGADE SIMULATION
BCT	BRIGADE COMBAT TEAM
BD	BATTLEFIELD DISTRIBUTION
BDAR	BATTLE DAMAGE ASSESSMENT AND REPAIR
BDE	BRIGADE
BDU	BATTLE DRESS UNIFORM
BG	BRIGADIER GENERAL
BFA	BATTLEFIELD FUNCTIONAL AREA
BIT/BITE	BUILT-IN-TEST/BUILT-IN-TEST EQUIPMENT
BN	BATTALION
BOB	BREAKOUT BOXES
BOIP	BASIS OF ISSUE PLAN
BOS	BATTLEFIELD OPERATING SYSTEM
BPS	BALLISTIC PROTECTIVE SYSTEM
BSA	BRIGADE SUPPORT AREA
BSTF	BASE SHOP TEST FACILITY
BTU	BRITISH THERMAL UNIT
BU	BACK UP
C	COMBAT
C&GSC	COMMAND AND GENERAL STAFF COLLEGE
C2	COMMAND AND CONTROL
C2V	CONTROL AND COMMAND VEHICLE
C4	COMMAND, CONTROL, COMMUNICATIONS AND COMPUTER

C4RDP	COMMAND, CONTROL, COMMUNICATIONS AND COMPUTER (C4) REQUIREMENTS DEFINITION PROGRAM
C4I	COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS, AND INTELLIGENCE
CAA	CONCEPT ANALYSIS AGENCY
CAC	COMBINED ARMS COMMAND
CALL	CENTER FOR ARMY LESSONS LEARNED
CALS	COMPUTER-AIDED ACQUISITION AND LOGISTICS SUPPORT
CASCOM	COMBINED ARMS SUPPORT COMMAND
CASCOM-ISD	COMBINED ARMS SUPPORT COMMAND- INFORMATION SYSTEMS DIRECTORATE
CASI	COMBAT SERVICE SUPPORT AUTOMATED INFORMATION SYSTEMS INTERFACE
CAV	CAVALRY
CBC	CARGO BED COVERS
CBT	COMMON BRIDGE TRANSPORTER
CD	COMPACT DISK
CDR	COMMANDER
CEFA	COMBAT SERVICE SUPPORT ENABLER FUNCTIONAL ASSESSMENT
CEP	CONCEPT EXPERIMENTATION PROGRAM
CHCS	COMBAT HEALTH CARE SYSTEM
CHLS	COMBAT HEALTH LOGISTICS SYSTEM
CHS	COMMON HARDWARE AND SOFTWARE/ (or) COMBAT HEALTH SUPPORT
CHU	CARGO HANDLING UNIT
CINC	COMMANDER-IN-CHIEF
CK	CONTAINERIZED KITCHEN
CL	CLASS (OF SUPPLY)
CLV	CONTRACTOR LOGISTICS VENTURE
CMF	CAREER MANAGEMENT FIELDS
CMOS	CARGO MOVEMENT OPERATIONS SYSTEM
CMT	CONTACT MAINTENANCE TRUCK
COBRA	(Proper name for type of Army helicopter)
COE	COMMON OPERATING ENVIRONMENT
COEA	COST AND OPERATIONAL EFFECTIVENESS ANALYSIS
COMPO	COMPOSITION OF FORCE - 1 (ACTIVE DUTY), 2 (NATIONAL GUARD), 3 (ARMY RESERVES, 4 (UNRESOURCED REQUIREMENTS)
CONUP	CONTINUOUS OPERATIONS PLAN
CONUS	CONTINENTAL UNITED STATES
COTS	COMMERCIAL-OFF-THE-SHELF
CPO	CIVILIAN PERSONNEL OFFICE
CPT	CAPTAIN

CPU	CENTRAL PROCESSING UNIT
CROP	CONTAINER ROLL IN/ROLL OUT PLATFORM
CS	COMBAT SUPPORT
CSA	CHIEF OF STAFF, U. S. ARMY
CSH	COMBAT SUPPORT HOSPITAL
CSMU	CRASH SURVIVABLE MEMORY UNIT
CSS	COMBAT SERVICE SUPPORT
CSSAMO	COMBAT SERVICE SUPPORT AUTOMATION MANAGEMENT OFFICE
CSSCS	COMBAT SERVICE SUPPORT CONTROL SYSTEM
CSSL	CONTAINERIZED SELF SERVICE LAUNDRY
CSSMMP	COMBAT SERVICE SUPPORT MODERNIZATION MASTER PLAN
CTA	COMMON TABLE OF ALLOWANCE
CTASC	CORPS/THEATER ADP SERVICE CENTER
CTIS	CENTRAL TIRE INFLATION SYSTEM
CTS	CONTACT TEST SET
CUCV	COMMERCIAL UTILITY CARGO VEHICLE
D	DOCTRINE
DLA	DEFENSE LOGISTIS ACTIVITY
DA	DEPARTMENT OF THE ARMY
DAMMS-R	DEPARTMENT OF THE ARMY MOVEMENTS MANAGEMENT SYSTEM-REDESIGN
DAMPL	DEPARTMENT OF THE ARMY MASTER PRIORITY LIST.
DAWE	DEPARTMENT OF THE ARMY WARFIGHTING EXPERIMENT
DBFS	DEFENSE BATTLEFIELD FINANCE SYSTEM
DCA	DATA CONNECTOR ASSEMBLY
DCD	DIRECTOR OF COMBAT DEVELOPMENTS
DCS	DEFENSE COMMUNICATIONS SYSTEM
DCSLOG	DEPUTY CHIEF OF STAFF, LOGISTICS
DCSOPS	DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
DDA	DIVISION DESIGN ANALYSIS
DDAP	DIGITAL, DIAGNOSTIC, AND PROGNOSTIC
DDN	DEFENSE DATA NETWORK
DECU	DIGITAL ELECTRONIC ENGINE CONTROL UNIT
DEPMEDS	DEPLOYABLE MEDICAL SHELTER
DFAS	DEFENSE FINANCE AND ACCOUNTING SERVICE
DFBS	DEFENSE FINANCE BATTALION SYSTEM
DFD	DIRECTOR OF FORCE DEVELOPMENT
DII	DEFENSE INFORMATION INFRASTRUCTURE
DISCOM	DIVISION SUPPORT COMMAND
DISE	DISTRIBUTION ILLUMINATION SYSTEMS, ELECTRICAL
DIT	DIGITAL INTERACTIVE TRAINING
DIVARTY	DIVISION ARTILLERY
DLA	DEFENSE LOGISTICS ACTIVITY

DMLSS	DEFENSE MEDICAL LOGISTICS STANDARD SUPPORT SYSTEM
DMR	DIGITAL MEDICAL RECORD
DMSO	DIVISION MEDICAL SUPPLY OFFICE
DOD	DEPARTMENT OF DEFENSE
DOS	DAYS OF SUPPLY
DS	DIRECT SUPPORT
DSA	DIVISION SUPPORT AREA
DSC	DIGITAL SOURCE COLLECTION
DSS	DIVISION SURGEON SECTION
DT & OT I	DEVELOPMENTAL TEST & OPERATIONAL TEST I
DTLOMS	DOCTRINE, TRAINING, LEADER DEVELOPMENT, ORGANIZATION, MATERIAL, AND SOLDIER
DTTS	DEFENSE TRANSPORTATION TRACKING SYSTEM
DVE	DRIVER VISION ENHANCER
DVO	DIRECT VIEW OPTIC SYSTEMS
E	ENABLERS
E-ORC	ENABLERS-OFFSETS REQUIRED CAPABILITY
E/I	ENABLER/INITIATIVES
EAC	ECHELONS ABOVE CORPS
EAD	ECHELONS ABOVE DIVISION
ECC	EXPERIMENTAL CONTROL CELL
ECP	EQUIPMENT CHANGE PROPOSAL
ECU	ELECTRONIC ENGINE CONTROL UNIT
EEA	ESSENTIAL ELEMENT OF ANALYSIS
EMP	ELECTRO MAGNETIC PULSE
EO	ELECTRO OPTICS
EOD	EXPLOSIVE ORDNANCE DISPOSAL
EODRV	EOD RESPONSE VEHICLE
EOTF	ELECTRO-OPTIC TEST FACILITY
EOTS	ELECTRO-OPTIC TEST STATION
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPLRS	ENHANCED POSITION LOCATION REPORTING SYSTEM
EPP	ELECTRICAL POWER PLANT
EQUATE	ELECTRONIC QUALITY ASSURANCE TEST EQUIPMENT
ERS	ELECTRONIC REPAIR SHELTER
ESP	EXTENDED SERVICE PROGRAM
ETM	ELECTRONIC TECHNICAL MANUAL
EW	ELECTRONIC WARFARE
EXFOR	EXPERIMENTAL FORCE
F&A	FINANCE AND ACCOUNTING
FAA	FEDERAL AVIATION ADMINISTRATION
FAADC21	FORWARD AREA AIR DEFENSE COMMAND, CONTROL, and INTELLIGENCE

FAMPS	FAILURE ANALYSIS AND MAINTENANCE PLANNING SYSTEM
FASTALS	FORCE ANALYSIS SIMULATION of THEATER ADMINISTRATIVE and LOGISTICAL SUPPORT
FB	FINANCE BATTALION
FBCB2	FORCE XXI BATTLE COMMAND - BRIGADE AND BELOW
FBI	FEDERAL BUREAU OF INVESTIGATION
FC	FINANCE COMMAND
FD	FUNCTIONAL DESCRIPTION
FG	FINANCE GROUP
FIN	FINANCE
FLIR	FORWARD LOOKING INFRARED SYSTEM
FLPT	FORK LIFT PALLET TRAILER
FM	FIELD MANUAL
FMS	FORCE MANNING SYSTEM
FMSA	FORCE MANAGEMENT SUPPORT AGENCY
FMTV	FAMILY OF MEDIUM TACTICAL VEHICLES
FOC	FUTURE OPERATIONAL CAPABILITY
FORSCOM	FORCES COMMAND
FP	FORCE PACKAGE
FRS	FORWARD REPAIR SYSTEM
FRS-H	FORWARD REPAIR SYSTEM - HEAVY
FSB	FORWARD SUPPORT BATTALION
FSC	FORWARD SUPPORT COMPANY
FSMC	FORWARD SUPPORT MEDICAL COMPANY
FUE	FIRST UNIT EQUIPPED
FUPP	FULL UP POWER PACK
FXXI	FORCE XXI
FY	FISCAL YEAR
GAO	GENERAL ACCOUNTING OFFICE
GCSS	GLOBAL COMBAT SUPPORT SYSTEM
GPH	GALLONS PER HOUR
GPS	GLOBAL POSITIONING SYSTEM
GS	GENERAL SUPPORT
GUI	GRAPHICAL USER INTERFACE
GVW	GROSS VEHICULAR WEIGHT
HEMTT	HEAVY EXPANDED MOBILE TACTICAL TRUCK
HEMTT-LHS	HEAVY EXPANDED MOBILE TACTICAL TRUCK- LOAD HANDLING SYSTEM
HERCULES	HEAVY EQUIPMENT RECOVERY COMBAT UTILITY LIFT AND EVACUATION SYSTEM
HET	HEAVY EQUIPMENT TRANSPORTER
HMMWV	HIGH-MOBILITY MULTI-PURPOSE WHEELED VEHICLE
HMT	HIGH MOBILITY TRAILER
HNS	HOST NATIONS SUPPORT

HQ	HEADQUARTERS
HQDA	HEADQUARTERS, DEPARTMENT OF THE ARMY
HRV	HEAVY RECOVERY VEHICLE
HVY	HEAVY
I	INITIATIVE
I/O	INPUT/OUTPUT
ICH	IMPROVED CARGO HELICOPTER
ICODES	INTEGRATED COMPUTERIZED DEPLOYMENT SYSTEM
ICS3	INTEGRATED COMBAT SERVICE SUPPORT SYSTEM
ICT	INTEGRATED CONCEPT TEAM
ID	IDENTIFICATION
IDD	INTERIM DIVISION DESIGN
IDLH	IMMEDIATE DANGER TO LIFE AND HEALTH
IECU	IMPROVED ENVIRONMENTAL CONTROL UNIT
IED	IMPROVISED EXPLOSIVE DEVICE
IEDRM	INTERACTIVE ELECTRONIC DIAGNOSTIC AND REPAIR MANUAL
IETM	INTERACTIVE ELECTRONIC TECHNICAL MANUAL
IFTE	INTEGRATED FAMILY OF TEST EQUIPMENT
ILS	INTEGRATED LOGISTICS SUPPORT
IM	INFORMATION MANAGEMENT
IMI	INFORMATION MANAGEMENT INTEGRATION
IN	INFANTRY
IOS	INTERNAL ORGANIZATION FOR STANDARDIZATION
IOT	INITIAL OPERATIONAL TEST
IOTE	INITIAL OPERATIONAL TEST AND EVALUATION
IPT	INDIRECT PRODUCTIVE TIME
IR	INFRARED
IRB	IMPROVED RIBBON BRIDGE
IRV	IMPROVED RECOVERY VEHICLE
ISCEA	INFORMATION SYSTEM COST AND ECONOMIC ANALYSIS
ISO	INFORMATION SYSTEMS OFFICER
ITAP	IMPROVED TOXICOLOGICAL AGENT PROTECTIVE
ITO/TMO	INSTALLATION TRANSPORTATION OFFICE/TRAFFIC MANAGEMENT OFFICE
ITRO	INTERSERVICE TRAINING REQUIREMENTS ORGANIZATION
ITV	INTRANSIT VISIBILITY
IVIS	INTRA-VEHICULAR INFORMATION SYSTEM
JAG	JUDGE ADVOCATE SCHOOL
JPAV	JOINT PERSONNEL ASSET VISIBILITY
JROC	JOINT REQUIRED OPERATIONAL CAPABILITY (document)
JULL	JOINT UNIFORMED LESSONS LEARNED
JV	JOINT VENTURE
Kw	KILOWATT
LADS	LAUNDRY ADVANCED SYSTEM

LAN	LOCAL AREA NETWORK
LHS	LOAD HANDLING SYSTEM
LIA	LOGISTICS IMPACT ANALYSIS
LIDD	LIGHTWEIGHT DISPOSAL DEARMER
LIN	LINE ITEM NUMBER
LME	LIGHT MAINTENANCE ENCLOSURE
LMTV	LIGHT MEDIUM TACTICAL VEHICLE
LOF	LIFE-TIME OIL FILTER
LOG	LOGISTICS
LOGCAP	LOGISTICS CIVIL AUGMENTATION PROGRAM
LOGSA	LOGISTICS SUPPORT AGENCY
LOGSITREP	LOGISTICS SITUATION REPORT
LR	LETTER REQUIREMENT
LRF/D	LASER RANGE FINDER/DESIGNATOR SYSTEM
LRU	LINE REPLACEABLE UNIT
LSE	LOGISTICS SUPPORT ELEMENT
LTC	LIEUTENANT COLONEL
LUPS	LOGISTICS UNIT PRODUCTIVITY SYSTEM
LUT&E	LIMITED USER TEST and EVALUATION
LW	LAND WARRIOR
M	MATERIEL/ (or) MODERNIZATION
M3V	MOBILE MEDICAL MONITORING VEHICLE
MAA	MISSION AREA ANALYSIS
MAC	MAINTENANCE ALLOCATION CHART
MACOM	MAJOR COMMAND
MAJ	MAJOR
MARC	MULTI-TECHNOLOGY AUTOMATED READER CARD
MARSS	MAINTENANCE AND REPAIR SUPPORT SYSTEM
MB	MEGABYTES
MC4	MEDICAL COMMUNICATION FOR COMBAT CASUALTY CARE
MCS	MANEUVER CONTROL SYSTEM
MDEP	MANAGEMENT DECISION EXECUTIVE PACKAGE
MEDCOM	MEDICAL COMMAND
MEDLOG BN	MEDICAL LOGISTICS BATTALION
MEDLOG CO	MEDICAL LOGISTICS COMPANY
MEDLOG-D	MEDICAL LOGISTICS - DIVISION
MEDSUP	MEDICAL SUPPORT
METT-T	MISSION, ENEMY, TERRAIN, TROOPS, AND TIME AVAILABLE
MG	MAJOR GENERAL
MHE	MATERIAL HANDLING EQUIPMENT
MILSTRIP	MILITARY STANDARD REQUISITIONING AND ISSUE PROCEDURES
MILTA	MICROCHIP TECHNOLOGY FOR LOGISTICS APPLICATION

MIPS	MODIFIED INTEGRATED PROGRAM SUMMARY
MITLA	MICROCHIP TECHNOLOGY FOR LOGISTICS APPLICATION
MJ	MILITARY JUDGMENT
MKT	MOBILE KITCHEN TRAILER
MMDB	MISSION MAINTENANCE DATA BASE
MMMB	MEDICAL MATERIEL MANAGEMENT BRANCH
MMP	MODERNIZATION MASTER PLAN
MNS	MISSION NEEDS STATEMENT
MOADS	MANEUVER ORIENTED AMMUNITION DISTRIBUTION SYSTEM
MOD	MODIFICATION
MOS	MILITARY OCCUPATIONAL SPECIALTY
MPI	MULTIPLE POWER INPUT
MRC	MAJOR REGIONAL CONFLICT
MRI	MEDICAL REENGINEERING INITIATIVE
MSB	MAIN SUPPORT BATTALION
MSAC	MEDICAL SITUATIONAL AWARENESS AND CONTROL
MSE	MOBILE SUBSCRIBER EQUIPMENT
MSG	MASTER SERGEANT
MSR	MAIN SUPPLY ROUTE
MSS	MUNITIONS SURVIVABILITY SOFTWARE
MST	MOBILE SUPPORT TEAM
MTBF	MEAN TIME BETWEEN FAILURE
MTS	MOVEMENT TRACKING SYSTEM
MWO	MODIFICATION WORK ORDER
N/A	NOT APPLICABLE
NBC	NUCLEAR, BIOLOGICAL and CHEMICAL
NC	NETWORK COMPUTING
NCO	NON-COMMISSIONED OFFICER
NDI	NONDEVELOPMENTAL ITEM
NEOF	NO EVIDENCE OF FAILURE
NES	NETWORK ENCRYPTION SYSTEM
NET	NEW EQUIPMENT TRAINING
NG	NATIONAL GUARD
NLT	NO LATER THAN
NTC	NATIONAL TRAINING CENTER
NVG	NIGHT VISION GOGGLES
O	ORGANIZATION
O/A	ON/ABOUT
O&O	ORGANIZATION & OPERATION
O&S	OPERATIONS AND SUPPORT
OBA	OXYGEN BREATHING APPARATUS
OBOGS	ON BOARD OXYGEN GENERATING SYSTEM
ODS	OPERATION DESERT STORM

OEC	OPERATIONAL EVACUATION COMMAND
OJE	OPERATION JOINT ENDEAVOR
OMA	OPERATIONS and MAINTENANCE, ARMY
OMS/MP	OPERATIONAL MODE SUMMARY/MISSION PROFILE
OOTW	OPERATIONS OTHER THAN WAR
OPA	OTHER PROCUREMENT, ARMY
OPTEC	OPERATIONAL PLANNING, TEST, AND EVALUATION COMMAND
OPTEMPO	OPERATIONAL (OPERATING) TEMPO
OR	OPERATIONAL READINESS
ORD	OPERATIONAL REQUIREMENTS DOCUMENT
OST	ORDER SHIP TIME
OT	OPERATIONAL TEST
PACMED	PACIFIC MEDICAL
PACOM	PACIFIC COMMAND
PAM	PAMPHLET
PC	PORTABLE COMPUTER
PDA	PERSONAL DATA (OR DIGITAL) ASSISTANT
PE	PROGRAM ELEMENT
PERSITREP	PERSONNEL SITUATION REPORT
PIN	PERSONAL IDENTIFICATION NUMBER
PLS	PALLETIZED LOAD SYSTEM
PM	PROJECT MANAGER
PMCS	PREVENTIVE MAINTENANCE CHECKS and SERVICES.
PM-MEP	PROGRAM MANAGER FOR MOBILE ELECTRIC POWER
PM-TMDE	PROGRAM MANAGER-TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT
PMA	PERSONAL MAINTENANCE AID
POI	PROGRAM OF INSTRUCTION
POL	PETROLEUM
POM	PROGRAM OBJECTIVE MEMORANDUM
POSNAV	POSITIVE NAVIGATION
PQAS	PETROLEUM QUALITY ANALYSIS SYSTEM
PSS	PERSONNEL SERVICE SUPPORT
PSSCS	PERSONNEL SERVICES SUPPORT CONTROL SYSTEM
PSY	PERSONNEL STAFF YEAR
PUMA	POCKET UNIT MAINTENANCE AID
QM	QUATERMASTER
QTR	QUARTER
R&D	RESEARCH & DEVELOPMENT
RAF	RADIO FREQUENCY
RAM	RELIABILITY, AVAILABILITY, AND MAINTAINABILITY
RAP	REMEDIAL ACTION PROGRAM
RC	RESERVE COMPONENT
RCT	REMOTE CONTROLLED TRANSPORTER

RDT&E	RESEARCH, DEVELOPMENT, TEST & EVALUATION
RECORM	REMOTE CONTROLLED RECONNAISSANCE MONITOR
RF	RADIO FREQUENCY
RM	RESOURCE MANAGEMENT
RML	REVOLUTION IN MILITARY LOGISTICS
ROC	REQUIRED OPERATIONAL CAPABILITY
ROM	READ ONLY MEMORY
RONs	REMOTE ORDNANCE NEUTRALIZER SYSTEM
ROWPU	REVERSE OSMOSIS WATER PURIFICATION UNIT
RPM	REVOLUTIONS PER MINUTE
RTCC	ROUGH TERRAIN CONTAINER CRANE
RTCH	ROUGH TERRAIN CONTAINER HANDLER
SA	SITUATIONAL AWARENESS
SAAS	STANDARD ARMY AMMUNITION SYSTEM
SACIMS	SENSOR ARTIFICIAL INTELLIGENCE (AI) COMMUNICATIONS INTERACTIVE MAINTENANCE SYSTEM
SAMS	STANDARD ARMY MAINTENANCE SYSTEM
SARSS	STANDARD ARMY RETAIL SUPPLY SYSTEM
SASO	STABILITY AND SUPPORT OPERATIONS
SC	SUPPLY CIRCULAR
SFC	SERGEANT FIRST CLASS
SICPS	STANDARD INTEGRATED COMMAND POST SHELTER
SIDPERS	STANDARD INSTALLATION/DIVISION PERSONNEL SYSTEM
SIMEX	SIMULATION EXERCISE
SINGARS	SINGLE CHANNEL GROUND-AIR RADIO SYSTEM
SLA	STRATEGIC LOGISTICS AGENCY
SLOT	SELF-LOADING/OFFLOADING TRAILER
SME	SUBJECT MATTER EXPERT
SME-MJ	SUBJECT MATTER EXPERT – MILITARY JUDGMENT
SN-ICE	STATEMENT OF NEED-INDIVIDUAL CLOTHING AND EQUIPMENT
SOP	STANDARD OPERATING PROCEDURE
SPO	SECURITY, PLANS, AND OPERATIONS
SPORT	SOLDIER'S PORTABLE ON-SYSTEM REPAIR TOOL
SPSR	SUPPLY POINT STATUS REPORT
SRA	SYSTEM RESEARCH AND ANALYSIS
SRU	SHOP REPLACEABLE UNIT
SSA	SUPPLY SUPPORT ACTIVITY
SSI	SOLDIER SUPPORT INSTITUTE
STAMIS	STANDARD ARMY MANAGEMENT INFORMATION SYSTEM
STAR	SYSTEM THREAT ASSESSMENT REPORT
STE	SIMPLIFIED TEST EQUIPMENT
STE-ICE	SIMPLIFIED TEST EQUIPMENT-INTERNAL COMBUSTION ENGINE
STEPO	SELF-CONTAINED TOXIC ENVIRONMENT PROTECTIVE

STON	OUTFIT
SWA	SHORT TON
T-MED	SOUTHWEST ASIA
TAA	TELEMEDICINE
TAMMIS	TACTICAL ASSEMBLY AREA/ (or) TOTAL ARMY ANALYSIS
	THEATER ARMY MEDICAL MANAGEMENT INFORMATION
	SYSTEM
TAP	TOXICOLOGICAL AGENT PROTECTIVE
TAPDB	TOTAL ARMY PERSONNEL DATA BASE
TAV	TOTAL ASSET VISIBILITY
TB	TECHNICAL BULLETIN
TBD	TO BE DETERMINED
TC AIMS	TRANSPORTATION COORDINATOR'S AUTOMATED
	INFORMATION FOR MOVEMENTS SYSTEM
TCACCIS	TRANSPORTATION COORDINATOR COMMAND AND
	CONTROL INFORMATION SYSTEM
TDA	TABLE OF DISTRIBUTION AND ALLOWANCES
TDP	TOTAL DISTRIBUTION PROGRAM
TECOM	TEST AND EVALUATION COMMAND
TED	TURBINE ENGINE DIAGNOSTICS
TEMOD	TEST EQUIPMENT MODERNIZATION
TEP	TACTICAL ELECTRIC POWER
TEXCOM	TEST AND EXPERIMENTATION COMMAND
TF	TASK FORCE
TFXXI	TASK FORCE XXI
TI	TACTICAL INTERNET
TIGER	TACTICAL INTERACTIVE GROUND EQUIPMENT REPAIR
TM	TECHNICAL MANUAL
TMDE	TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT
TMIP	THEATER MEDICAL INFORMATION PROGRAM
TMT	TRANSPORTATION MOTOR TRANSPORT
TOA	TOTAL OBLIGATION AUTHORITY
TOE	TABLE OF ORGANIZATION AND EQUIPMENT
TPN	TACTICAL PACKET NETWORK
TPS	TEST PROGRAM SET
TQG	TACTICAL QUIET GENERATOR
TRAC	TRADOC ANALYSIS CENTER
TRAC-LEE	TRADOC ANALYSIS CENTER- FORT LEE
TRAC-SAC	TRADOC ANALYSIS CENTER-STUDY AND ANALYSIS
	CENTER
TRADOC	(UNITED STATES ARMY) TRAINING AND DOCTRINE
	COMMAND
TRANSCOM	TRANSPORTATION COMMAND
TRAPR	TRANSPORTATION RESEARCH ACCOUNTING AND PHONE
	REPORTING

TRASR	TRANSPORTATION RESEARCH ACCOUNTING AND SATELLITE REPORTING
TRI-TAC	TRI-SERVICE TACTICAL COMMUNICATION SYSTEM
TSA	THEATER STORAGE AREA
TSM	TRADOC SYSTEM MANAGER
TTP	TACTICS, TECHNIQUES, AND PROCEDURES
TVAR	TASK VEHICLE AVAILABILITY RATE
TWV	TACTICAL WHEELED VEHICLE
UDR	UNIVERSAL DATA RECOVERY
UFD	USER FUNCTIONAL DESCRIPTION
UFR	UNFUNDED REQUIREMENT
UIC	UNIT IDENTIFICATION CODE
ULLS	UNIT LEVEL LOGISTICS SYSTEM
UM	UNIT MAINTENANCE
UMC	UNIT MOVEMENT COORDINATOR
UMO	UNIT MOVEMENT OFFICER
UMT	UNIT MINISTRY TEAM
USAARC&S	UNITED STATES ARMY ARMOR CENTER & SCHOOL
USAAVNC&S	UNITED STATES ARMY AVIATION CENTER & SCHOOL
USAF	UNITED STATES AIR FORCE
USAOC&S	UNITED STATES ARMY ORDNANCE CENTER & SCHOOL
USAOMMC&S	UNITED STATES ARMY ORDNANCE MISSILE MUNITIONS CENTER & SCHOOL
USAPPC	UNITED STATES ARMY PUBLICATION AND PRINTING . COMMAND
USAR	UNITED STATES ARMY RESERVE
USATA	UNITED STATES ARMY TEST, MANAGEMENT, AND DIAGNOSTIC EQUIPMENT ACTIVITY
USMC	UNITED STATES MARINE CORPS
UUT	UNIT-UNDER-TEST
UXO	UNEXPLODED ORDNANCE
VCSA	VICE CHIEF OF STAFF, ARMY
VIC	VECTOR-IN-COMMANDER
VIMEPS	VEHICLE INTEGRATED MULTIPLE POWER SOURCE
VM	VELOCITY MANAGEMENT
VMF	VARIABLE MESSAGE FORMAT
WFLA	WARFIGHTING LENS ANALYSIS
WIN	WARFIGHTING INFORMATION NETWORK
WO	WARRANT OFFICER
WPSM	WARFIGHTER PHYSIOLOGICAL STATUS MONITOR
WRAP	WARFIGHTER RAPID ACQUISITION PROGRAM
WWW	WORLDWIDE WEB
ZLIN	ZULU LINE ITEM NUMBER

APPENDIX C

CEFA QUESTIONNAIRE

CEFA QUESTIONNAIRE

The CEFA questionnaire had three sections. **Section I** pertained to E/I descriptive information, as well as other information from recent Army actions (relevant reviews by HQDA ODCSOPS [in the 1996 Army Modernization Plan], HQ TRADOC's Jan 97 WFLA briefing to HQDA, CASCOM's Sep 96 CSS Materiel Master Plan) that collectively would serve as background. **Section II** addressed various peacetime factors that individually or collectively could provide insights into the programmatic status of the given E/I. **Section III** addressed a limited number of factors relating to wartime employment of the given E/I. SME assignments of subjective Peacetime, Wartime and Overall risk assessments were also part of the questionnaire.

a. For most of the following questions, the sets of possible type responses were devised in such a manner as to facilitate entry into a MicroSoft Access database for subsequent analysis.

b. The reader of this report is referred to Appendix H that contains a large pullout CEFA Matrix which summarizes the responses of the 65 mini-assessments contained in Volume II. The study team recommends that the Appendix H chart be removed from this report and displayed so that it can be reviewed while one reads the 65 mini-assessments.

c. Note: When formulating and documenting each assessment, the study team primarily used information as provided directly from the responding SME. However, the study team frequently injected information of its own, and in some cases provided a different opinion on things. The study team made every effort in each assessment to place this extra information inside brackets such as "[...]" That way the reader can differentiate SME-provided information from that developed by the study team.)

A. Section I. (Descriptive)

1. Title. The name of the given FXXI CSS E/I under review.
2. Designation. Possible response types are: "Initiative (I)," "Enabler (E)," and "Enabler-ORC (E-ORC)." Plus text which explains why such a designation is appropriate.
3. DTLOMS Area.
 - a. Primary: Possible response types are: "Doctrine," "Training," "Leader Development," "Organization," "Materiel," and "Soldiers." Plus text. This question was aimed at obtaining which DTLOMS area was most affected by this given E/I.
 - b. Secondary: Possible response types are: "Doctrine," "Training," "Leader Development," "Organization," "Materiel," and "Soldiers." Plus text.

4. CSS E/I Type (Digitization/Modernization [D,M, Both]). Possible response types are: "Digitization," "Modernization," and "Both." Plus text. This question was aimed at ascertaining the primary focus of the given E/I. "Digitization" was meant to categorize those E/I which were primarily computerization ('digits')-related. "Modernization" was meant to be those non-digitization related E/I. "Both" was for those E/I which were modernization efforts which also included computerization.

5. CSS BOS Function. (The study team recognizes that TRADOC is developing an Army Universal Task List (AUTL)³⁵ which may supercede existing TRADOC BOS. However, at the start of this CEFA the study team elected to use standard CSS BOS functions rather than AUTL.

a. Primary: Possible response types are: "Arm," "Fuel," "Fix," "Man," "Distribute," and "Sustainment Engineering." Plus text. This questionnaire was aimed at obtaining which CSS BOS function was most affected by the given E/I.

b. Secondary: Possible response types are: "Arm," "Fuel," "Fix," "Man," "Distribute," and "Sustainment Engineering." Plus text.

6. FXXI Priority. Possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. The intent here was for the SME to list what he thought was the priority of his specific E/I, and also to identify the source of such prioritization.

7. CASCOM's 4 Sep 96 CSS Materiel Master Plan Priority (CSSMMP). Possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. Annex G to this Plan prioritizes the items that are discussed in the basic document. Note that only "Logistics" items are considered in this plan. No medical or personnel-related systems are reviewed.

8. 31 Jan 97 HQ TRADOC WFLA Recommendations to HQDA ODCSOPS. Possible response types are: "Briefed," "Not Briefed," "N/A," and "Unknown." Plus text. The intent here was for the SME to identify if his E/I was recommended for additional funding for fielding to the First Digitized Division, and to discuss what risks if any were identified by the WFLA.

9. The 1996 US Army Modernization Plan. Possible response types are: Reviewed, Not Reviewed, N/A, Unknown. Plus text. The intent here was for the SME to provide for background any risk-related information that this plan may have discussed pertinent to his E/I. (The study team was advised in Feb 97 by personnel in HQDA ODCSOPS that due to fiscal constraints a 1997 plan may not be published. In order to expedite performance of this CEFA, the study team elected to continue to include the 1996 version for questionnaire purposes.) Note: This plan provides subjective assessments (Red, Amber or Green) of the Army's ability to support the modernization

³⁵ Draft HQDA Pamphlet XX, Army Universal Task List (AUTL), prepared by the Dynamic Research Corp. for HQ TRADOC, 14 Mar 97.

objectives. Page 22 of this plan defines these three risk ratings as follows: Red- means no capability to achieve the modernization objective exists; Amber- means a limited capability or quantity exists to achieve the modernization objective; and Green- means adequate capability and quantity exist to achieve the modernization objective.

B. Section II. (Peacetime risk)

10. Prerequisite(s).

a. FXXI E/I. Response types are: "Combat," "Combat Support (CS)," "CSS," "None," "N/A," and "Unknown." Plus text. The CEFA study methodology was to include a "Systems of Systems" review to show the interdependencies of the risks of an E/I on the risks of its FXXI prerequisites. As this study evolved, no SME nor the study team could ever locate an approved list of FXXI "Combat" or "CS" E/I. Informal contacts with HQ TRADOC personnel indicated that no such list existed, and that no study effort similar to this CEFA was being performed for the Combat and CS areas. Consequently, for this question and others that required knowledge of "non-CSS" FXXI E/I, SME responses may have unknowingly combined FXXI-related systems with non-FXXI systems. The original intent here was for the SME to identify and discuss those FXXI E/I which are needed as input to/must exist ("Prerequisite") for his given E/I to perform its intended purpose. Such was deemed crucial in assessing "risks." Furthermore, at this point it is important that the reader fully understand how the definition of "prerequisite" evolved during the conduct of this CEFA from "input to/must exist for a given E/I to perform its intended mission," to where it became associated with that which is "required for a given E/I to realize its full synergistic capabilities." The following explanation aids in an understanding of this notion.

Discussion.

(1) Consider the analogy of the human body. It has arms, legs, a heart, eyes, and many other organs. A functioning heart is clearly a "prerequisite" in the strictest sense. But eyes and limbs can be considered by some to also be "prerequisites" in the sense that they are needed for the body to "realize its full potential." At the start of the CEFA the intent was that a prerequisite was analogous to the body's heart. However, as the study evolved it became apparent that most if not all of the E/I have many diversified subcomponents and subfunctions, that when viewed collectively define the E/I.

(2) In this context, most if not all E/I have subcomponents that are essential (read "prerequisite" for the E/I to "realize its full synergistic potential;" e.g., medical situational awareness; maintenance situational awareness). Therefore, most E/I have no "prerequisite" in a fashion analogous say to the relationship that the heart has to the rest of the human body. The study team thinks that if in fact there were any such items deemed so critical (read: "prerequisite" analogous to the heart of the body), then

these critical items would likely be considered as part of the integral definition of the E/I itself.

(3) Most of the E/I have no critically required item, absence of which would cause the E/I to completely be of no benefit to the commander. Even without fully operational battlefield communications, most E/I would still be able to provide some benefits within their own functional area of operation and/or to those commanders located immediately nearby the E/I itself.

(4) The definition of a "prerequisite" and its subsequent interpretation by many SME became a contentious issue as the CEFA study matured. Many SME opted to interpret "prerequisite" as related to that which is critical for an E/I to "realize its full synergistic battlefield potential" and not in a fashion analogous to the relationship that the human heart has to the body.

b. Other (not designated as FXXI Combat, CS or CSS E/I) prerequisites. Possible response types are: "Combat," "Combat Support (CS)," "CSS," "None," "N/A," and "Unknown." Plus text. The intent here was similar to paragraph 10a above, but for "non"-FXXI items that the SME thought to be prerequisite for his E/I.

11. Overall risk status of

a. Prerequisite E/I. For each identified FXXI prerequisite (refer to paragraph 10a), the possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. This information would then serve as input to assessing the risk of the main FXXI CSS E/I under examination.

(Note. (1) This is the first reference to High, Medium, or Low risks. CEFA study guidance (Jan-Feb 97) defined these terms to be subjective assessments made by SME which were equal to the terms Red, Amber or Green. High risk and the term "Red", Medium risk and the term "Amber," and Low risk and the term "Green" were used interchangeably throughout this CEFA. The definition provided by CEFA study guidance for Red, Amber or Green risk came from AR 700-127 (Integrated Logistics Support). (a) Red: Significant problems with no solutions identified, or a solution being implemented with less than satisfactory results projected by the next major milestone. (b) Amber: Significant or minor problems identified, with a solution or work-around plan expected to be completed by the next major milestone date. And (c) Green: No problems.

(2) For informational purposes for the CEFA reader, the 1996 Army Modernization Plan, page 22, provided the following definitions of Red, Amber and Green risk. (a) Red; no capability to achieve the modernization objective exists, or capability is insufficient to defeat the threat or provide the required support. (b) Amber: a limited capability or quantity exists to achieve the modernization objective. And (c) Green: adequate capability and quantity exist to achieve the modernization objective.)

b. Other prerequisites. For each identified non-FXXI prerequisite (refer to paragraph 10b), the possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. This information would then serve as input to assessing the risk of the main FXXI CSS E/I under examination.

12. Adverse programmatic (peacetime) risks on

a. The FXXI "prerequisite" E/I (refer to paragraph 10a) if this given CSS E/I is not fielded. Possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. Information to be used in the Systems of Systems risk assessment.

b. The other (non-FXXI) prerequisites (refer to paragraph 10b) if this given CSS E/I is not fielded. Possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. Information to be used in the Systems of Systems risk assessment.

13. What FXXI E/I depend on ("require") this given CSS E/I in order to function? Possible response types are: "None," "Specify," "Unknown," and "N/A." Plus text. The intent here was to again acquire Systems of Systems-type risk linkages. Where specific FXXI E/I were identified as requiring the given FXXI CSS E/I, the response "Specify" was used for the CEFA data base, and the SME then provided supporting explanations. As this study evolved and due to the fact that there were no available lists of those E/I officially designated as FXXI "Combat" and "CS", this question (and related responses) generally evolved into addressing any Combat or CS item (be it a declared "FXXI E/I" or whatever).

14. Adverse programmatic risks on "dependent" E/I (those identified in paragraph 13 above) if this given FXXI CSS E/I is not fielded. Possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. Information to be used in the Systems of Systems risk assessment.

15. What FXXI E/I will "benefit" due to fielding this given CSS E/I? Possible response types are: "None", "Specify", "Unknown", and "N/A". Plus text. As this study evolved and due to the fact that there were no available lists of those E/I officially designated as FXXI "Combat" and "CS", this question (and related responses) generally evolved into addressing any Combat or CS item (be it a declared "FXXI E/I" or whatever).

16. Supporting analytical studies. Possible response types are: "Yes", "No", "Unknown", and "N/A". Plus text. The intent here was to describe the who/what/where/why/and how of the supporting studies, especially as to how they relate to "QUANTIFIABLY" supporting any purported increases in efficiency/effectiveness and/or decreases in manpower requirements attributable to fielding the given FXXI CSS E/I.

17. Changes in manpower requirements caused by fielding this given CSS E/I. Possible response types are: "Decrease", "Increase", "N/A", "Unknown", and "None." Plus text. CEFA study guidance requested that to the extent possible "quantified" estimates be provided as well as supporting rationale (e.g., linkage to the identified analytical studies identified in paragraph 16 above.). Also, SME were asked to identify if they knew of any "second order" impacts on manpower requirements related to their given E/I. For example, if their E/I intended to reduce "crew" manpower requirements in comparison to the size of the crew required for the basecase equipment being replaced, SME were asked to report on this. Further, to the extent that they could, SME were also asked to respond about any collateral, second order "maintenance" manpower requirements (perhaps increases over the basecase) attributable to introduction of their new given E/I. However, in most cases this information was not available, primarily due to the fact that many E/I are still very early in their conceptual or prototype stages.

18. Related changes in CSS efficiency. Possible response types are: "Decrease", "Increase", "N/A", "Unknown", and "None." Plus text. CEFA study guidance to SME generally linked the term "efficiencies" to such measures of performance as timeliness, accuracy, use of resources, etc.; and the term "effectiveness" to either the inherent effectiveness of the given E/I itself (e.g., can clean so many pounds of clothing per time period) or perhaps even to battlefield effectiveness itself. Each SME was responsible for defining what the unique "efficiencies" and "effectiveness" would be for his own system. Each SME was asked to provide to the extent possible "quantified" estimates as well as supporting rationale (e.g., linkage to the analytical studies identified in paragraph 16 above).

19. Related changes in CSS effectiveness. Possible response types are: "Decrease", "Increase", "N/A", "Unknown", and "None." Plus text. Refer to paragraph 18 above.

20. Related force structure (equipment and/or organizational) changes. (This question dealt with the "non-manpower" elements of force structure. Manpower was specifically addressed separately in paragraph 17 above due to its importance to this study. Refer to Chapter 1, Introduction for a further explanation of how reductions in manpower requirements relate to risk.)

a. In equipment requirements (other than the equipment associated with the given CSS E/I itself). Possible response types are: "Decrease", "Increase", "N/A", "Unknown", and "None." Plus text. It is important to note that this question excludes (1) equipment that is part of the definition of the given FXXI CSS E/I being fielded, and (2) the basecase equipment that is being replaced- "IF" such basecase equipment is generally replaced on a one-for-one basis. If, however, the new FXXI CSS E/I replaces large amounts of presently fielded equipment, then such current basecase equipment would be listed as a response here. The intent of this question was to capture information in those instances where the new FXXI CSS E/I especially impacts (decreases/increases) a very large amount of basecase equipment. This was left up to the subjective call of the responding SME.

b. In organization(s). Possible response types are: "Decrease," "Increase," "N/A," "Unknown," and "None." Plus text.

21. Status of CSS E/I Operational Concept. Possible response types are: "Developed," "Not Developed," "N/A," and "Unknown." Plus text.

22. Approved documentation (e.g., MNS, ORD, BOIP). The intent was to indicate that as an E/I had more approved requirements documents, it had a greater likelihood of programmatic success.

a. MNS. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text.

b. ORD. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text.

c. BOIP. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text.

23. CSS E/I training in TRADOC schools. This question was added at the request of the former CDR, CASCOM in Feb 97. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text.

24. Examined in

a. TF XXI Army Warfighting Experiment (AWE), Mar 97. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text. Jan-Feb 97 CEFA study guidance requested SME to provide quantitative results where possible. Quantitative results were preferred over qualitative results or even anecdotal SME-Military Judgment. The study team and numerous SME wanted to review the Operational Test and Evaluation Command's (OPTEC) report of the Mar 97 AWE. However, the report was not made available to HQ TRADOC until about Sep 97, and even then HQ TRADOC limited who could review it. Consequently, SME could not provide any official OPTEC information. But, the study team researched and located several CASCOM and other Command briefings relating to TF XXI AWE results. These are included in this CEFA where appropriate.

b. TRAC's Division Design Analysis (DDA) Study (Phases I, II, and III)³⁶. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text. SME did not have access to information in order to directly answer this question as to how the DDA Study analyzed their specific FXXI CSS E/I. This study was conducted by TRAC-LEE and focused primarily on use of the Vector-in-Commander (VIC) model. The TRAC-LEE analyst conducting the CSS part of this study advised the study team that the DDA CSS Analysis did not explicitly address any of the 65 FXXI CSS E/I.

³⁶ TRAC-LEE's DDA Phase I, II, and III CSS reports, Jan-Oct 97. Author: Ms McGrady.

However, some enablers were implicitly considered when CASCOM designed their new CSS concept and force structures which were modeled in DDA (VIC model). The analyst went on to indicate that "...limited CSS enabler representation in the VIC model restricts in-depth analysis (of effects of the FXXI CSS E/I) based on DDA modeling outputs." For additional information CEFA readers are referred to TRAC-LEE's DDA Phase I, II, and III CSS Reports on file in TRAC-LEE.

(The study team notes that in Oct-Dec 96 one intent of CEFA was to quickly acquire from CSS SME the quantified effects of each of the FXXI CSS E/I so they could be explicitly modeled in TRAC's FXXI VIC analyses. However, as discussed in detail within the CEFA main report, most SME could not provide quantified estimates of even ranges of expected reductions in manpower requirements (associated with the "enablers") or for increases in E/I efficiencies/effectiveness.)

c. To be examined in the Nov 97 Division AWE (DAWE). Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text. Results of this upcoming AWE will not be available in time for this CEFA. This question was specifically asked in order to determine if a pattern was being established to analytically examine a select number of the FXXI CSS E/I. This could then provide sources of information for future updates to this CEFA.

25. Tested elsewhere. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text. Again, keeping in mind the 1990 GAO critique of the Army's AOE redesign efforts (refer to Chapter 1 of the main CEFA report for a full explanation), a major concern was to locate "QUANTIFIABLE" information which supported any increases in E/I efficiencies/effectiveness, as well as the quantifiable basis for proposing that a given E/I would in fact decrease manpower requirements. For this question, SME often provided the dates of "future" tests. For those instances where a test was identified for the "near" future, limited CEFA study resources on the part of the SME as well as of the study team precluded revisiting this issue and updating it with information from the future test itself.

26. Funded in (a) Pre FY 98 years, (b) FY 98-03 POM, and (c) EPP FY 04-12. Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text. The intent was to indicate that as an E/I had more funding, it had a greater likelihood of programmatic success.

27. Planned BOIP (connectivity between Force Packages [FPs]). Possible response types are: "Yes," "No," "N/A," and "Unknown." Plus text. The original intent of this question was to acquire information showing the extent to which the given E/I "was being" fielded. The larger the extent of fielding indicated a greater likelihood of programmatic success (i.e., lower risk). However, as this study evolved and since fielding is dependent on available procurement money, SME often responded with their fielding "intentions," versus the "actual status" of the given E/I fielding. Future CEFA updates should reword this question to alleviate this ambiguity.

28. Technical capabilities. Possible response types are: "Proven," "Unproven," "Unknown," and "N/A." Plus text. Again, SME were requested to quantify the extent to which all or part of their E/I technical capabilities have been proven. As with all other questions, SME were also asked to provide the basis for their responses.

29. Logistics Integration Agency (LIA)'s 15 elements of Integrated Logistics Support (ILS) assessment. Possible response types are: "Assessed," "Not Assessed," "Unknown," and "N/A." Plus text. The LIA used to conduct reviews of the 15 elements of ILS on many new Army items and assign Red, Amber or Green risk ratings. This review process has now been taken over by Operational Test and Evaluation Command (OPTEC). The intent of this question was to examine/document the programmatic risks of any given E/I as reported by LIA/OPTEC. These reviews are now on the Internet. In most cases SME did not provide responses to this question. The study team however did locate some OPTEC ILS reviews for selected E/I which are reported in their respective CEFA mini-assessments. The intent of this question was to add to the body of programmatic risk-related information for a given E/I.

30. Fielding schedule. The intent of these questions was to highlight the extent of the planned fielding. If a lot of money was obligated for a given E/I and it was scheduled to be fielded to say the First Digitized Division, then this would indicate a strong likelihood of programmatic success. However, as this study evolved several SME responded with what is "hopefully" planned for a given E/I, rather than what the Army actually plans as based on obligated procurement funds. These questions need to be clarified if they will ever be used in any future CEFA updates.

a. In time for the First Digitized Div (Sep 2000). Possible response types are: "Yes," "No," "Unknown," and "N/A." Plus text.

b. In time for the First Digitized Corps (2006). "Yes," "No," "Unknown," and "N/A." Plus text. Note: when this CEFA began in Jan 97, HQDA plans called for fielding the First Digitized Corps by FY 2006. In Aug 97 HQDA ODCSOPS redesignated FY 2004 as the planned fielding date. No attempt was made to acquire updates from SME for this change in FY. CEFA answers are based on the FY 2006.

c. During FY 07-10. Possible response types are: "Yes," "No," "Unknown," and "N/A." Plus text.

31. Overall Peacetime (Programmatic) risk. Possible response types are: "Red," "Amber," "Green," "Unknown," and "N/A." Plus text. CEFA study guidance requested each SME to review their responses to all the questions in Section II above and subjectively assign a peacetime risk rating. SME were also asked to provide a short narrative explanation to accompany their response. There was no attempt to weight any given Section II question/response or combine responses into any mathematical formula. It was recognized from the very beginning that many of the questions/responses are truly not independent in a "mathematically" sense. In those instances where a SME could not or did not provide a response to this question, the study team responded instead based on

the SME-provided information. In those cases where a given E/I relied on a prerequisite E/I (refer to paragraph 10 above), many SME did not know the prerequisite's programmatic risks assessment. In those cases the study team applied the prerequisite's risk to the SME's original response, assigning the worst case risk to the given FXXI CSS E/I. For example, if a SME assessed the programmatic risk of his E/I to be "Amber," but it had a "Red" prerequisite, then the study team assigned a "Red" as the overall programmatic risk to the given FXXI CSS E/I, and also provided an explanation. These results and observed peacetime "risk factors" are discussed in Chapter 3.

C. Section III (Wartime Risks).

32. Likelihood of CSS E/I performance degradation during wartime due to threat, RAM failure or lack of requisite force structure. Possible response types are: "High," "Medium," "Low," "N/A," and "Unknown." Plus text. CEFA study guidance requested information about "adverse impacts on mission accomplishment" say from threat, Reliability, Availability and Maintainability (RAM) failure, lack of sufficiently authorized force structure (e.g., enough personnel and equipment). The intent here was to acquire information as to the risks related to wartime employment of a given E/I.

33. Likelihood of prerequisite C,CS or CSS E/I wartime degradation. Possible response types are: "High," "Medium," "Low," "None," "Unknown," and "N/A." Plus text. The intent here was to take into consideration the wartime employment risk of any prerequisite (as identified in paragraph 10 above), as deemed critical for wartime employment of the given E/I under review. In some cases SME did not know the wartime employment risks for the prerequisites that they identified as critical for wartime employment of their given E/I. If the prerequisite were in fact an identified FXXI CSS E/I, the SME most likely did not have visibility into the CEFA assessment for the prerequisite as rendered by a different SME. In those cases, the study team acquired this information and responded accordingly.

34. Wartime backup (BU) system. SME were asked to provide only a narrative response. The intent was to acquire more information on which the SME could subjectively assess the wartime employment of his given FXXI CSS E/I.

35. Adverse wartime impact if this CSS E/I is degraded with "NO" BU system available. Possible response types are: "High," "Medium," "Low," "None," "N/A," and "Unknown." Plus text. The original intent was for questions #35 and #36 to be mutually exclusive, as based on the SME response to question #34. That is, if question 34 indicated that there was to be "NO" BU, then the SME would answer this question #35 accordingly, and answer question #36 with an "N/A." Similarly, if question #34 indicated a planned wartime BU system, then the SME would respond with a "N/A" to question #35, and then answer question #36 accordingly. However, as this study evolved some SME interpreted that a response was required under both conditions; i.e., if there was a BU (question #36) and if the BU did not exist for some reason (question #35). For

any future CEFA study updates, these questions relating to risks associated with wartime BU systems need to be constructed with less ambiguity.

36. Adverse wartime impact if this CSS E/I is degraded "WITH" a BU system available. Possible response types are: "High," "Medium," "Low," "None," "N/A," and "Unknown." Plus text. Please refer to paragraph 35 above.

37. Adverse wartime impacts due to limited fielding of this given CSS E/I. Possible response types are: "High," "Medium," "Low," "None," "N/A," and "Unknown." Plus text. The intent here was to acquire even more information concerning any wartime employment risks of the given E/I as it related to fielding to selected FPs, or perhaps to only select units within say FP1 alone. If a given E/I were to be fielded say only to FP1, then it is possible that some basecase systems would likely have to continue to exist in the remaining FPs. Thus, interoperability risks (perhaps between Active Duty, Reserve, and National Guards units) would surface and play a detrimental role in wartime, notwithstanding perhaps having to train mechanics to repair two different systems, supplying two systems, etc.

38. Other adverse wartime impacts (e.g., scenario dependent). Possible response types are: "High," "Medium," "Low," "None," "N/A," and "Unknown." Plus text. For example, the intent here was to see if fielding the given E/I say in the cold of Korea could have different employment risks than say fielding it in the heat of Saudi.

39. Overall wartime risk associated with employment of this CSS E/I. Possible response types are: "Red," "Amber," "Green," and "Unknown," Plus text. The SME was asked to use the information he provided for questions #32- #38 and assign a subjective risk rating. Where a prerequisite (paragraph 10 above) for a given E/I was involved, the study team attempted where possible to augment the SME's response accordingly. Refer to the discussion in paragraph # 31 above. The study team used the worst case risk (of the given E/I under review or its prerequisites) to assign an overall wartime risk rating.

D. Section IV (Overall Risk and Data Source).

40. Overall risk (considering both programmatic and wartime risks). Possible response types are: "Red," "Amber," "Green," and "Unknown," Plus text. This response was always the worst of the two- the assigned programmatic risk (refer to question #31 above) and the assigned wartime risk (refer to question #39 above). No attempt was made to mathematically weight or combine into any formula the contribution of either peacetime or wartime risk to derive an overall risk rating.

41. Ordinal ranking of this CSS E/I by the CSS DCD. The original study intent as briefed to the CDR, CASCOM in Jan and Apr 97 was to first acquire from his CSS DCD their (proponent) designated FXXI CSS E/I. Then their respective SME would work the CEFA assessment and develop overall risk ratings. Next, the list of DCD-approved FXXI CSS E/I was to have been submitted to the CDR, CASCOM for his

review and approval, after which plans then called for the entire listing of all E/I being reviewed by each DCD. The peacetime/wartime/overall risk ratings would **not** have been made available to the DCD. However, they would have been asked to rank order each E/I as to its perceived worth measured in terms of indirect contribution to battlefield effectiveness. The mathematical procedure to be used would have generated both an ordinal and cardinal ranking.

The study team was assured that the E/I provided by SME were in fact approved by their proponent DCD. **This resulted in 65 candidate FXXI CSS E/I.** Original plans called for having CDR, CASCOM review and approve this list. However, the study team was advised that higher priority CASCOM efforts along with limited CASCOM resources precluded obtaining the CDR, CASCOM's review and approval. Consequently, the study team never obtained the CDR, CASCOM's approval of what his DCD's submitted as "candidates" for FXXI CSS E/I. Therefore, the study team did not go back to the DCD and request that they develop an ordinal ranking of any E/I list. As briefed by the study team to the CDR, CASCOM in Jan 97, once the DCD rank ordered the "approved" set of FXXI CSS E/I, then this information was to have been added to the set of CEFA mini-assessments. This would have yielded a basis for the CDR, CASCOM to assess the perceived risks of what his DCD thought were the very important (say the top 25% of the list) and the least important (say the bottom 25%). One notional example that intrigued the former CDR, CASCOM was the issue if some of the top 25% were rated overall "Red" say due to lack of money and requirements documents, whereas say some of the bottom 25% were rated overall "Green" (had necessary money and other requirements). This analysis would have provided him with a basis for perhaps modifying the procedures used for "future CASCOM reviews," as they might relate to allocating the time of staff officers to develop requirements documents and/or to acquire scarce procurements dollars for FXXI CSS E/I.

The study team did, however, ask TRAC-LEE personnel participating in other FXXI analyses to play the role of individual DCD and to rank order the set of 65 FXXI CSS E/I. Their resulting ordinal and cardinal rankings were subsequently used in this analysis.

42. Cardinal ranking of this CSS E/I by the CSS DCD. Refer to paragraph # 41 above. Each E/I's cardinal score was computed from its ordinal score and represented a surrogate for its perceived worth thought of in terms of its indirect contribution to battlefield effectiveness.

43. Comparison of rankings to CDR, CASCOM's 4 Sep 96 CSS MMP priorities. The study team originally had intended for informational purposes only to compare the ordinal rankings obtained in paragraph # 41 above to those priority rankings rendered in the Sep 96 CSSMMP. However, without any CDR, CASCOM-approved listing of the FXXI CSS E/I, the study team did not complete this task.

44. Remarks. The SME was asked to provide narrative remarks as deemed appropriate to support any CEFA response.

45. Data Sources. The study team provided the names of the responding SME.

APPENDIX D

LISTING OF E/I DETERMINED TO BE ARMY of EXCELLENCE (AOE) CARRYOVERS AND ARMY AFTER NEXT (AAN) ITEMS

A-1. AOE CARRYOVERS

<u>#</u>	<u>Title</u>
1.	Automated Movement Flow Tracking (AMFT)
2.	Army Common User Communications System
3.	Army field Feeding System
4.	Army Space Heaters
5.	All-Terrain Lifter, Army System (ATLAS)
6.	Barge Derrick
7.	CSS Automated Information Systems Interface (CAISI)
8.	Containerized Maintenance Facility
9.	Corps/Theater ADP Service Center (CTASC)
10.	Department of the Army Movement Management System (DAMMS)-R
11.	Enhanced Throughput Operations concept
12.	Equipment Deployable Storage System
13.	Field Latrines
14.	Family of Medium Tactical Vehicles (FMTV)
15.	FMTV Wrecker
16.	Force Provider
17.	4K lb. Rough Terrain Forklift
18.	High Mobility Multipurpose Wheeled Vehicle (HMMWV)
19.	Improved Mechanic's Coveralls
20.	Integrated Logistics Automation
21.	Landing Craft Mechanized
22.	Landing Craft utility
23.	Large Tug 100 foot
24.	Light Medium Tactical Vehicles (LMTV)
25.	Logistics Support Vessel
26.	LOGMARS
27.	Modular Ammunition Company
28.	Modular Causeway System
29.	Modular CSS Organizations
30.	Modular General Purpose Medium Tent
31.	Modular Multifunctional Organizations
32.	Modular Quartermaster Organizations
33.	Modular Transportation Organization (Cargo Transfer Company)
34.	Multi-Fuel Burner
35.	Network Encryption System (NES)
36.	Packaged Water System
37.	POL-Advanced Aviation Forward Area Refueling System (AAFARS)
38.	Port Control and Communications Center
39.	Pusher Tug
40.	Rough Terrain Container Handler (RTCH)
41.	Rucksack Deployable Law Office and Library
42.	Standard Army Maintenance System (SAMS) I and II

A-1. AOE CARRYOVERS (continued)

#	Title
43.	Standard Army Retail Supply System-Objective (SARSS-O)
44.	Showers- Small Unit
45.	Single Shelter Switch
46.	6K lb. Rough Terrain Forklift
47.	6K lb. Variable Reach Forklift
48.	Space Heaters
49.	Split-Based Operations
50.	Shipment Tracking and Redistribution System (STARS)
51.	Sustained Tempo
52.	Tactical Wheeled Vehicle (TWV) Enhancements
53.	Unit Level Logistics System (ULLS)- Air
54.	ULLS-Ground

A-2. AAN Items

#	Title
1.	Advanced Image Generation Technology
2.	Advanced Man/Machine Interface
3.	Advanced Materials Technology
4.	Application Software Embedded in Sensors
5.	Advanced Polymers and Ceramics
6.	Automated Artificial Intelligence Assisted Sensor/Data Fusion
7.	Bio Technology
8.	Composite Materials
9.	Data Compression Technologies
10.	Data Interoperability/Synchronization
11.	Electro Chemistry
12.	Embedded Sensors
13.	Enhanced Communications Technology
14.	Enhanced Navigation Technologies
15.	Fiber-Optic Networks
16.	Genetically Engineered Materials
17.	High Resolution Video
18.	Intelligent Software Agents
19.	Internet
20.	Light Weight Power Technology
21.	Low Power Electronics
22.	Massive Data Storage and Management
23.	Micro-Electro-Mechanical Systems

A-2. AAN Items (continued)

#	Title
24.	Micro- Flat Panel Displays
25.	Micro-Robotics
26.	Multi-Channel Radio Frequency (RF) Links
27.	Multi-Media Authoring Technology
28.	Power
29.	Prognostics
30.	Real Time Video
31.	Robotics
32.	Satellite
33.	Sensor/Data Fusion
34.	Small Volume/Weight Microprocessor and Storage Devices
35.	Smart Packaging
36.	Source Data Automation
37.	Systems Miniaturization
38.	Voice Recognition
39.	Wireless Networking

APPENDIX E

DEFINITIONS

Definitions used in CEFA.

1. Initiative. DTLOMS change for which there is currently no associated force structure reduction. Initiatives may transition to enablers as they are funded/resourced within a target window of consideration...FXXI-by FY 2010, etc., reach maturity and demonstrate significant savings as to allow consideration for force structure savings.

2. Enabler. DTLOMS change (equipment, organization, concept/doctrine, etc.) that when fielded demonstrates/promises sufficiently increased efficiency in operation as to allow reductions in force structure, or offsets required capabilities not currently resourced.

3. Risk.

a. Peacetime risk: A subjective assessment of the magnitude of the problems associated with the programmatic issues for fielding a given E/I (e.g., development/approval of requirements documents, ILS issues, testing, firm plans/funding to field the E/I within the FXXI time frame (FY 98-10), and where appropriate the programmatic risks related to any "prerequisite" systems deemed critical for fielding the given E/I). Assigned risk ratings of Red, Amber or Green are derived from AR 700-127 (Integrated Logistics Support) and are as follows:

(1) Red: Significant problems with no solutions identified, or a solution being implemented with less than satisfactory results projected by the next major milestone.

(2) Amber: Significant or minor problems identified, with a solution or work-around plan expected to be completed by the next major milestone date.

(3) Green: No problems.

b. Wartime risk: A subjective assessment of the magnitude of the problems associated with both the likelihood that a given E/I may fail on the battlefield and the adverse wartime impacts resulting from such failure.

c. Overall risk: A subjective assessment (Red, Amber, or Green) of the magnitude of the overall (peacetime and wartime) risk associated with a given E/I. CEFA study guidance established the overall risk rating to be the worse case situation considering both peacetime and wartime risk ratings.

4. Prerequisite. Anything deemed essential or critical to a given E/I for performance of intended mission.

Discussion.

(1) Consider the analogy of the human body. It has arms, legs, a heart, eyes, and many other organs. A functioning heart is clearly a "prerequisite" in the

strictest sense. But eyes and limbs can be considered by some to also be "prerequisites" in the sense that they are needed for the body to "realize its full potential." At the start of the CEFA the intent was that a prerequisite was analogous to the body's heart. However, as the study evolved it became apparent that most if not all of the E/I have many diversified subcomponents and subfunctions, that when viewed collectively define the E/I.

(2) In this context, most, if not all, E/I have subcomponents that are essential (read "prerequisite" for the E/I to "realize its full synergistic potential." For example, medical situational awareness; maintenance situational awareness). Therefore, most E/I have no "prerequisite" in a fashion analogous say to the relationship that the heart has to the rest of the human body. This study team thinks that if in fact there were any such items deemed so critical (read: "prerequisite" analogous to the heart of the body), then these critical items would likely be considered as part of the integral definition of the E/I itself.

(3) Most of the E/I have no critically required item that would cause the E/I to completely be of no benefit to the commander. Even without fully operational battlefield communications, most E/I would still be able to provide some benefits within their own functional area of operation and/or to those commanders located immediately nearby the E/I itself.

(4) The definition of a "prerequisite" and its subsequent interpretation by many SME became a contentious issue as the CEFA study matured. Many SME opted to interpret "prerequisite" as related to that which is critical for an E/I to "realize its full synergistic battlefield potential" and not in a fashion analogous to the relationship that the human heart has to the body.